DP-8800Plus/DP-9900Plus/DP-9900

Digital Ultrasonic Diagnostic Imaging System

Service Manual

CE 0123

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- the product is used in accordance with the instructions for use.

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3. Return address: Please send the part(s) or equipment to the address offered by Customer Service department

Company Contact

Manufacturer: **Shenzhen Mindray Bio-Medical Electronics Co., Ltd.**

Address: **Mindray Building, Keji 12th Road South, Hi-tech Industrial Park, Nanshan, ShenzhenShenZhen518057, P.R.China,518057**

Tel: **+86 755 26582479 26582888**

Fax: **+86 755 26582934 26582500**

EC-Representative: **Shanghai International Holding Corp. GmbH(Europe)**

Address: Eiffestraβe 80, 20537 Hamburg Germany

Tel: 0049-40-2513175

Fax: 0049-40-255726

Safety Precautions

1. Meaning of Signal Words

In this operation manual, the signal words ⚠**DANGER**, ⚠**WARNING**, ⚠**CAUTION** and **NOTE** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal word	Meaning
⚠**DANGER**	**Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**
⚠**WARNING**	**Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
⚠**CAUTION**	**Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**
NOTE	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.

2. Meaning of Safety Symbols

Symbol	Description
	Type-BF applied part Note: All ultrasound transducers that can be connected to this system are Type-BF applied part.
	"Attention" indicates the points requiring attention. Be sure to read the operation manual concerning these points before using the equipment.

3. Safety Precautions

Please observe the following precautions to ensure patient and operator safety when using this system.

⚠DANGER: Do not use flammable gasses such as anesthetic gas, oxygen or hydrogen, or flammable liquids such as ethanol, near the system, because there is danger of explosion.

⚠WARNING:

1. **Do connect the plugs of the system and peripherals connected to the system to the wall receptacle meeting the ratings indicated on the rating nameplate. Using adapter or multi-functional receptacle may affect the system's grounding performance and thus cause leakage current exceeding safety requirement.**

   Be sure to connect the video printer to the designated AC outlet on the system with the provided cable. Using other cables may cause electric shock.

2. **Be sure to connect the potential-equalization lead wire before inserting the system power plug into the receptacle and be sure to remove the system power plug from the receptacle before disconnecting the wire, in order to avoid electric shock.**

3. **Connect the earth conductor only before turning ON the system. Disconnect the grounding cable only after turning OFF the system. Otherwise, electric shock may result.**

4. **For the connection of power and grounding, follow the appropriate procedures described in the operation manual. Otherwise, there is risk of electric shock. Do not connect the grounding cable to a gas pipe or water pipe, otherwise functional grounding may not be effective or there may be risk of a gas explosion.**

5. **Before cleaning the system, be sure to disconnect the power cable to avoid electric shock.**

6. **No waterproof device is applied to the system. Do not use the system in any place with the possibility of water ingress. There is risk of electric shock if any water is sprayed on or into the system. If you carelessly spray any water onto/into the system, contact the Mindray sales office, customer service department or representative.**

7. **Use the transducer carefully. In case that the human body contacts the scratched transducer surface, immediately stop using the transducer and contact the Mindray sales office, customer service department or representative. There is risk of electric shock if using the scratched transducer.**

8. **Be careful not to let the patient contact the ultrasound equipment. If the ultrasound equipment is defective, there is risk of electric shock.**

9. **Do not use the transducers other than those provided by Mindray. If a transducer other than those provided by Mindray is connected, the equipment and the transducer may be damaged, causing an accident such as a fire in the worst case.**

10. **Do not subject the transducers to knocks. Use of defective transducers may cause electric shock.**

11. **Do not open the shell or panel. If open the shell when the equipment is powered on, there may be a short circuit or electric shock.**

12. **Do not use the equipment at the same time use equipment such as an electric scalpel, high-frequency therapy equipment or a defibrillator, etc.**

13. **Precautions during transportation: When moving the equipment, hold the handle. If the user holds other sections, the equipment may be subject to unnatural force and may be damaged. Do not move the equipment in the left/right direction. If the equipment is moved in the left/right direction, the equipment may fall.**

14. **Accessory equipments connected to the analogue and digital interfaces must comply with relevant IEC standards. Furthermore all configurations should comply with the standard IEC60601-1-1. Everybody who connects additional equipments to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of IEC60601-1-1. If in doubt, consult Mindray customer service department or your local distributor.**

15. Prolonged and repeated use of keyboards can result in hand or arm nerve disorders in some individuals. Observe the local institution work safety/health regulations on keyboard use.

⚠CAUTION:

1. Precautions concerning clinical examination techniques

(1) This system can only be used by medical personnel fully trained in clinical examination techniques.

(2) This manual does not describe clinical examination techniques. Selection of the proper clinical examination technique must be based on specialized training and clinical experience.

2. Malfunctions due to radiowaves

(1) Use of radiowave-emitting devices in the proximity of this kind of medical electronic system may interfere with its operation. Do not bring or use devices which generate radio waves, such as cellular telephones, transceivers, and radio controlled toys, in the room where the system is installed.

(2) If a user brings a device which generates radio waves near the system, he must be instructed to immediately turn OFF the device. This is necessary to ensure the proper operation of the system.

3. Precautions concerning installation and movement of the system

(1) Be sure to install the system on a level floor and lock the casters. Otherwise, the system may move, and injure the patient.

(2) Do not push the system from the sides. If the system is pushed from the sides, it may fall down and cause injury.

(3) When the system is moved over a sloped surface, it must be moved slowly by two persons. Otherwise, the system may slide unexpectedly and cause a serious injury.

(4) Do not sit on the system.
The system may move, causing you to lose your balance and fall.

(5) Do not place any objects on top of the monitor. They may fall, causing injury.

(6) Confirm that the peripheral units are secured before you move the system. Otherwise, the peripheral units may fall and cause injury.

(7) When the system is moved over a step, exercise caution to protect the system from falling. When holding the system at the bottom to help move it over a step, take special care to prevent hand injuries.

4. Do not vibrate the equipment excessively (when moving the equipment); otherwise the mechanical parts (such as casters) may be damaged. If the system is often moved on a bumpy floor, contact the Mindray sales office, customer service department or representative.

5. Do not connect this system to outlets with the same circuit breakers and fuses that control the current of devices such as life-support systems. If this system malfunctions and generates an overcurrent, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.

6. Always keep the machine dry. Avoid transporting this machine quickly from the cold place to the warm place, otherwise condensation or water drops may be formed, which will cause short circuit.

7. If the circuit breaker is tripped or the fuse is blown, it indicates that the machine or the peripheral devices have problems. In these cases, the user cannot repair by him but contact the Mindray sales office, customer service department or representative.

8. There is no risk of high-temperature burns during routine ultrasound examinations, even if, due to environment temperature and exam modes, the surface temperature of the transducer exceeds the body temperature of the patient. To prevent high-temperature burns, do not apply the transducer to the same region on the patient for a long time. Apply the transducer only for as long as required time for diagnosis.

9. After the sterilization or disinfection of accessories, chemicals must be washed out or gases must be discharged thoroughly from the accessories. Remaining residual chemicals or gases will not only result in damage to the accessories but also can be harmful to human bodies.

10. Before examining a new patient, press 『Patient』 to delete the patient information and data recorded in the memory for the previous patient. Otherwise, the new data may be confused with the data of the previous patient.

11. Do not pull out plugs of the system and its accessories without turning OFF the power. Otherwise it may result in equipment damage or even electric shock.

12. Do not turn OFF the power supply of the system during printing, saving, or invoking. Otherwise it may result in abnormality of these processes.

NOTE:

1. Do not use the system in the vicinity of strong electromagnetic field (such as the transformer), which may affect the performance of the monitor.
2. Do not use the system in the vicinity of high-frequency radiation source (such as the cellular phone), which may affect the performance of the machine or even lead to failure.
3. To avoid damaging the system, do not use the system in following environment:
   (1) Locations exposed to direct sunlight
   (2) Locations subject to sudden changes in temperature
   (3) Dusty locations
   (4) Locations subject to vibration
   (5) Locations near heat generators
   (6) Locations with high humidity
4. Turn ON the system only after the power has been OFF for more than 10 seconds. If the system is turned ON immediately after being turned OFF, it may result in malfunction of the system.
5. Turn OFF the auxiliary power switch or stop transmission through the [Freeze] key before connecting or disconnecting a transducer. If a transducer is connected or disconnected with an image displayed, the system and/or the transducer may malfunction.
6. After using the transducer, remove the ultrasound gel on it and place the transducer on the transducer holder. Otherwise, water in the gel may enter the acoustic lens, thus adversely affecting the performance and safety of the transducer.

7. You can record the registration data (including the hospital data and patient data). To ensure the security of the data, be sure to back up the data on external storage media. Data stored in the system may be lost due to improper operation or an accident.
8. Do not apply external force to the control panel (e.g. leaning against it). Otherwise it may damage the system.
9. If the system is used in a small room, the room temperature may rise. Therefore, proper ventilation shall be provided.
10. The fuse, which is inside the machine, can be replaced only by the Mindray service engineer or the technician specified by Mindray.
11. When disposing of this system or any part of the system, contact Mindray sales office, customer service department or representative. Do not dispose of this system without consulting Mindray sales office, customer service department or representative first. Mindray does not assume any responsibility for damage resulting from disposal of this system without consulting Mindray.
12. Deterioration of electrical and mechanical safety characteristics (such as generation of a leakage current or deformation/abrasion of mechanical parts) and of image sensitivity and resolution may occur over a period of time. To ensure system performance, signing a maintenance and service contract to avoid accidents and misdiagnose is recommended.
13. The output power outlets on the main unit are used for providing power to recommended external optional devices. Do not connect other devices to the outlets, otherwise the output power may be exceeded and the system may malfunction.

4. Warning Labels

Various WARNING labels are attached to this system in order to call the user's attention to potential hazards.

The symbol ⚠ on the WARNING labels attached to the system indicates safety precautions.

The name, appearance, and the indication of each WARNING label are described in the Operation Manual. Read them carefully and understand them.

Contents

Chapter 1 System Introduction 1-1

1.1. Introduction of DP-8800Plus 1-1

1.1.1. Appearance 1-1

1.1.2. Rear Panel 1-3

1.1.3. Control Panel 1-4

1.2. Introduction of DP-9900Plus/DP-9900 1-6

1.2.1. Appearance 1-6

1.2.2. Rear Panel 1-8

1.2.3. Control Panel 1-10

Chapter 2 Hardware Introduction.....2-1

2.1. Hardware System 2-1

2.2. Boards 2-1

2.2.1. Main Board 2-1

2.2.2. Transducer Board 2-2

2.2.3. Connection Board 2-3

2.2.4. Output Board 2-9

2.2.5. I/O Board 2-12

2.3. Power Supply Board 2-12

2.3.1. Introduction 2-12

2.3.2. Working Procedure 2-13

2.3.3. Circuit Description 2-13

2.3.4. Protection Circuit 2-14

2.3.5. Maintenance 2-15

2.4. Principle of the LCD 2-18

2.4.1. Operating Principle of the Inverter Module 2-18

2.4.2. Working principle of the regulating board 2-20

Chapter 3 Disassembly of DP-9900Plus/DP-9900 3-1

3.1. System Structure 3-1

3.2. Disassembly of Monitor 3-2

3.3. Disassembly of Screen 3-3

3.4. Disassembly of Keyboard 3-3

3.4.1. Disassembly of Keyboard Cover 3-3
3.4.2. Disassembly of Trackball 3-4
3.4.3. Disassembly of Keyboard Board 3-5
3.4.4. Disassembly of TGC Board 3-5
3.5. Disassembly of CD-ROM 3-6
3.5.1. Locking Casters 3-6
3.5.2. Disassembly of Drawer and Transducer Cable Hanger 3-6
3.5.3. Disassembly of Rear Cover of Neck 3-7
3.5.4. Disassembly of Top Cover 3-7
3.5.5. Disassembly of Left Cover 3-8
3.5.6. Disassembly of Right Cover 3-9
3.5.7. Disassembly of Front Cover 3-9
3.5.8. Disassembly of CD-ROM 3-10
3.6. Disassembly of I/O Board 3-11
3.7. Disassembly of Air Outlet Fan Assembly 3-12
3.8. Disassembly of Hard Disk 3-12
3.9. Disassembly of Power Conversion Board 3-13
3.10. Disassembly of Air Intake Fan Assembly 3-14
3.11. Disassembly of Output Board, Main Board and Power Supply Board 3-15
3.12. Disassembly of Transducer Board 3-16
3.13. Disassembly of Cabinet 3-16
3.14. Diagram 3-17
3.15. Disassembly of the LCD Monitor Assembly 3-18
3.16. Replacing the OSD Board of the LCD Monitor 3-19
3.17. Replacing the inverter board and control board of the LCD 3-20
3.18. Replacing the LCD screen of the LCD Monitor 3-21
3.19. Disassembly of the LCD support arm assembly 3-23

Chapter 4 Disassembly of DP-8800Plus 4-1

4.1. System Structure 4-1
4.2. Disassembly of Monitor 4-2
4.3. Disassembly of Screen 4-3
4.4. Disassembly of Printer 4-4
4.5. Disassembly of Keyboard 4-4
4.6. Disassembly of Trackball 4-5
4.7. Disassembly of TGC Board 4-5

4.8. Disassembly of Transducer Cable Hanger 4-6
4.9. Disassembly of Handle 4-7

Chapter 5 Maintenance Requirements 5-1

5.1. Tools and Consumables 5-1
5.2. Maintenance Personnel 5-2

Chapter 6 System Maintenance 6-1

6.1. Cleaning 6-1
6.1.1. Procedure 6-1
6.1.2. Details 6-1
6.2. Software Maintenance 6-2
6.2.1. Software Upgrade 6-4
6.2.2. Installation/Uninstallation of DICOM 6-5
6.2.3. System Self-check 6-6
6.2.4. LCD test 6-6

Chapter 7 Troubleshooting 7-1

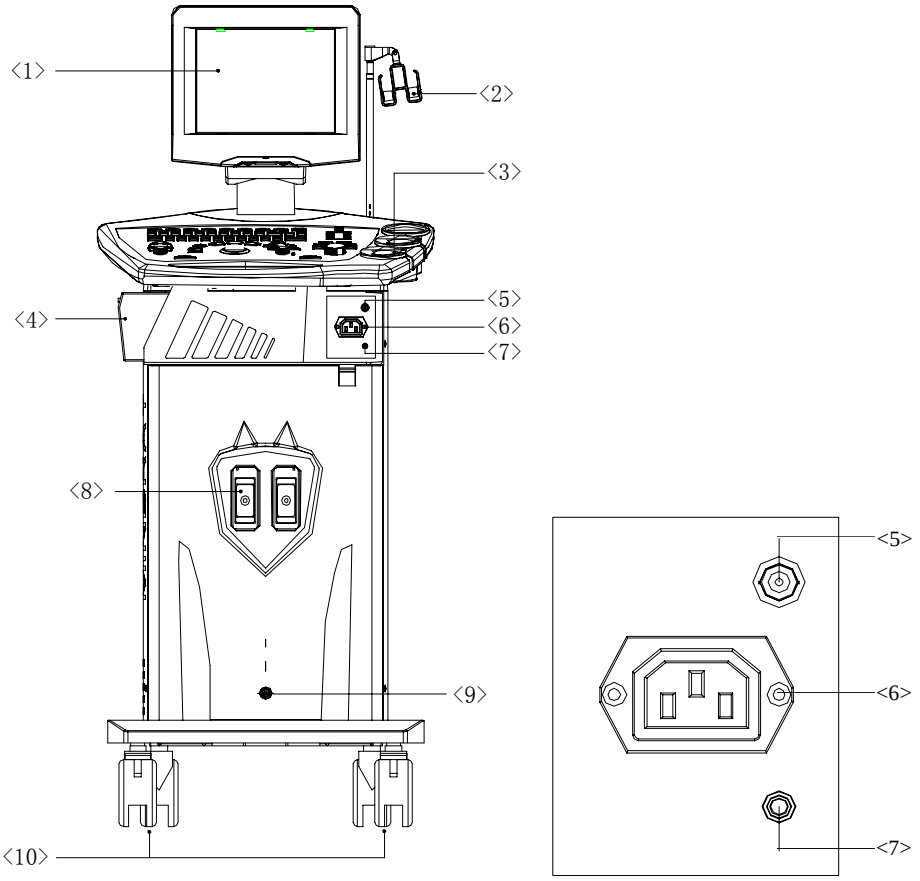
7.1. Power Supply 7-1
7.2. Monitor 7-1
7.3. Troubleshooting of LCD Blank Screen 7-2
7.4. Troubleshooting of Other Malfunctions of the LCD 7-2
7.5. Startup 7-3
7.6. Use 7-4
7.7. Software 7-5
7.8. Others 7-5

Appendix A Electrical Safety Inspection A-1

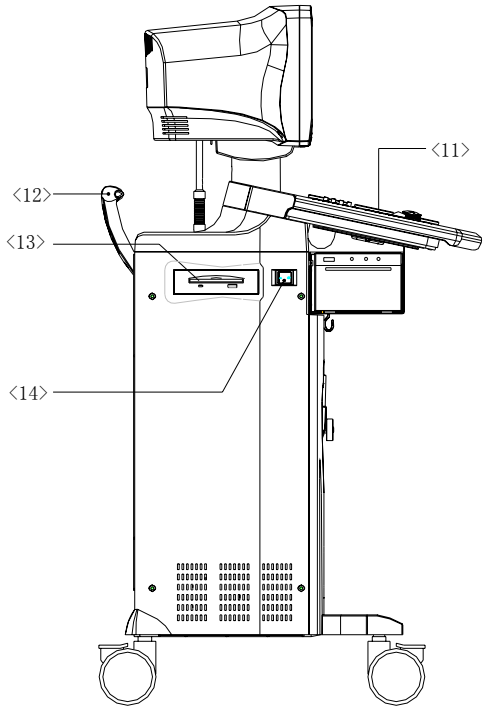
Chapter 1 System Introduction

1.1. Introduction of DP-8800Plus

1.1.1. Appearance



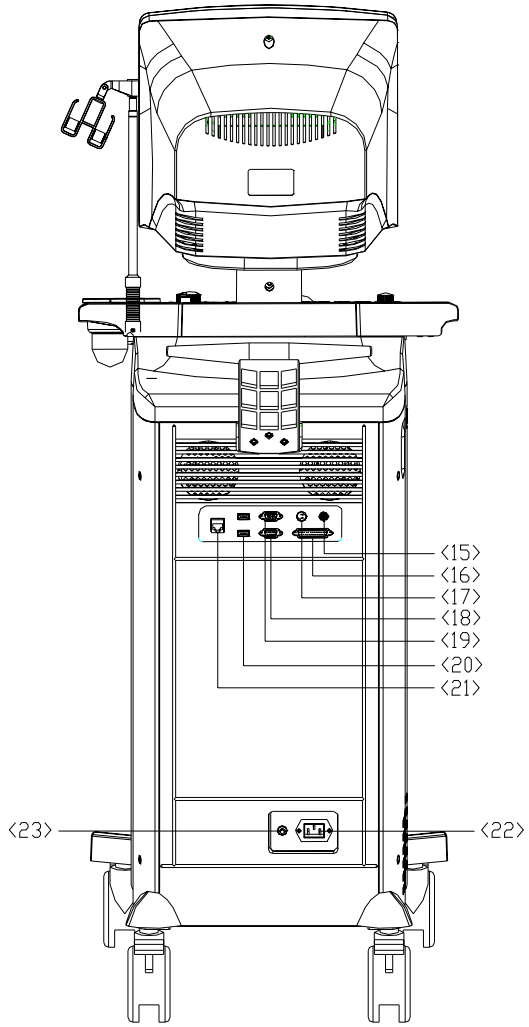
Front View



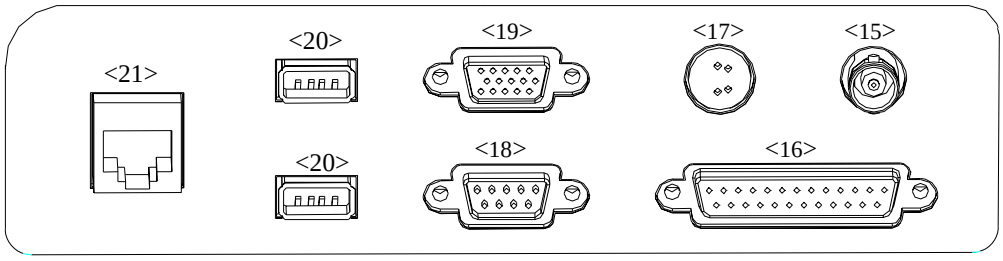
Left View

No.	Part	Introduction
<1>	Monitor	Display images and parameters, etc.
<2>	Transducer cable hanger	Hook for the transducer cable
<3>	Transducer holder	Place the transducer provisionally
<4>	Printer area	Place the video printer
<5>	Video out	Connect the video printer
<6>	AC out	Connect the AC power cable for the video printer
<7>	Remote	Connect the remote cable for the video printer
<8>	Transducer socket	Connect or disconnect the transducer with the main unit
<9>	Footswitch switch socket	Connect or disconnect footswitch
<10>	Casters	Lock or move the system
<11>	Control panel	User interface
<12>	Handle	Move the system
<13>	CD-RW	Backup data to a CD or read data from a CD
<14>	Power switch	Power on / off

1.1.2.Rear Panel



Rear View

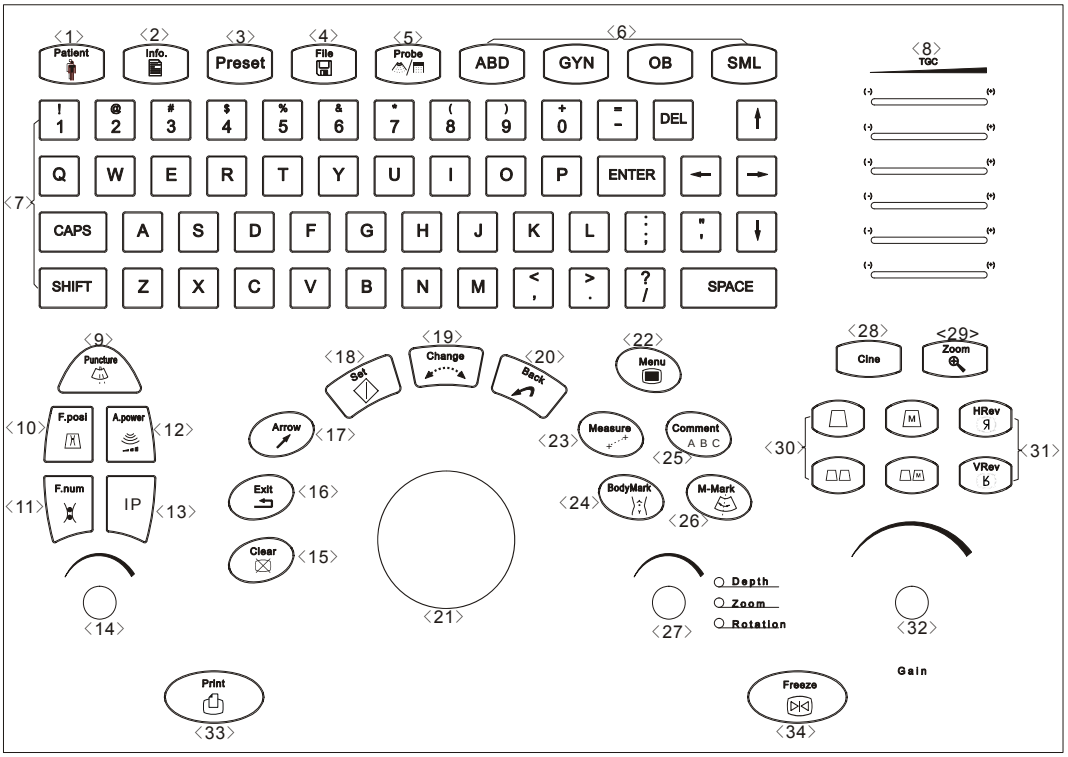


I/O Panel

No.	Name	Introduction
<15>	Video out	Connect the video printer or other video device

No.	Name	Introduction
<16>	Graph/text printer port	Connects the graph/text printer
<17>	S-Video port	Video output
<18>	RS-232	Rreserved
<19>	VGA port	VGA output
<20>	USB port	Connects the USB storage device or graph/text printer, etc.
<21>	Ethernet port	Connects network
<22>	AC input	Connects the power cable for the system
<23>	Equipotential terminal	Equipotential connecting

1.1.3.Control Panel



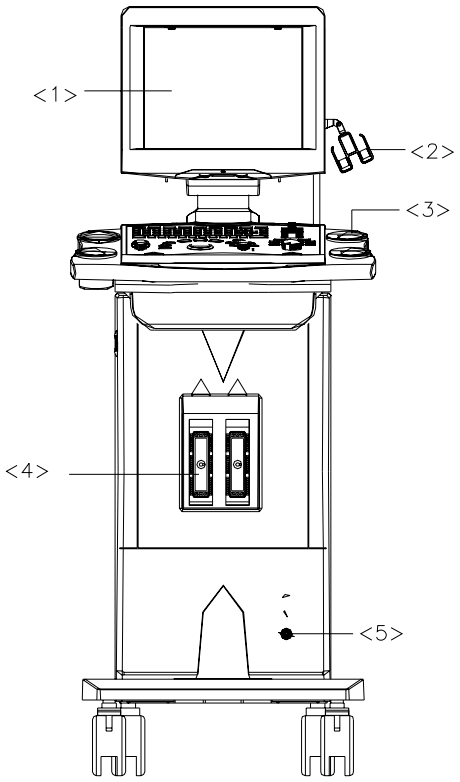
Control Panel

NO.	Key	Function
<1>	Patient	Delete the data for the previous patient, including the ID and measured values, and begin with a new patient.
<2>	Info	The patient information screen appears.
<3>	Preset	Invoke the registered initial settings (presets).
<4>	File	Activate storage or load files system
<5>	Probe	Switch transducers
<6>	ABD/GYN/OB/SML	Select exam mode
<7>	Character Key	Used to enter characters and symbols When backlight of SHIFT key is on, the symbol in the upper row on keys can be entered. When pressing CAPS key, the capital letter can be entered.
<8>	TGC	Adjust the ultrasound echo reception sensitivity according to the depth from the body surface.
<9>	Puncture	Enter needle guide menu
<10>	F.Posi	Enter the focus position adjusting mode.
<11>	F.Num	Enter the focus number adjusting mode.
<12>	A.power	Enter the acoustic power adjusting mode.
<13>	IP	Adjust the image quality according to the registered image conditions.
<14>	Parameter adjust knob	Adjust some value of Puncture, F.Posi, F.Num, A.Power and IP with combination of corresponding key.
<15>	Clear	Clear comments, body marks, measurements and results on screen
<16>	Exit	Exit the current work mode
<17>	Arrow	Enter the arrow comment mode
<18>	Set	Determine the cursor position for measurement, and confirm the selected items, and adjust the value or items in menus etc.
<19>	Change	Change the fixed end or active end in measurement.
<20>	Back	Delete the comment or the previous operations, and adjust the value or items in menus etc.
<21>	Trackball	Move the cursor or mark during image movement or measurement.
<22>	Menu	Open or close the menu on screen.
<23>	Measure	Go into measurement mode
<24>	BodyMark	Enter body marks mode.
<25>	Comment	Go into comment mode
<26>	M-Mark	Enter M-Mark mode

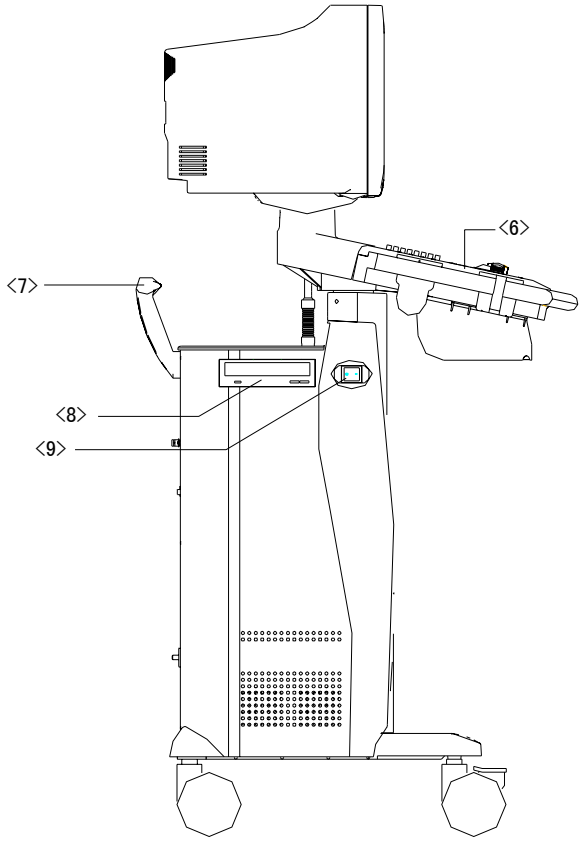
NO.	Key	Function
<27>	Depth/Zoom/ Rotation	Adjust the viewing depth for display, the zoom mode, and the arrow rotation of the ultrasound images.
<28>	Cine	Switch Manual/Auto CINE review. When the 『Cine』 lamp lights on, the system enter Manual Review mode; when the 『Cine』 lamp is off the system exits Manual Review mode.
<29>	Zoom	Enter the mode of amplifying the image
<30>	B/M/M+B/B+B	Select image mode
<31>	HRev / VRev	Reversal the image horizontally or vertically
<32>	Gain	Adjust the sensitivity of black/white images.
<33>	Print	Activate a printing function for a video printer connected.
<34>	Freeze	Freeze and unfreezes the image. If image is frozen, Output of acoustic power is stopped.

1.2. Introduction of DP-9900Plus/DP-9900

1.2.1. Appearance



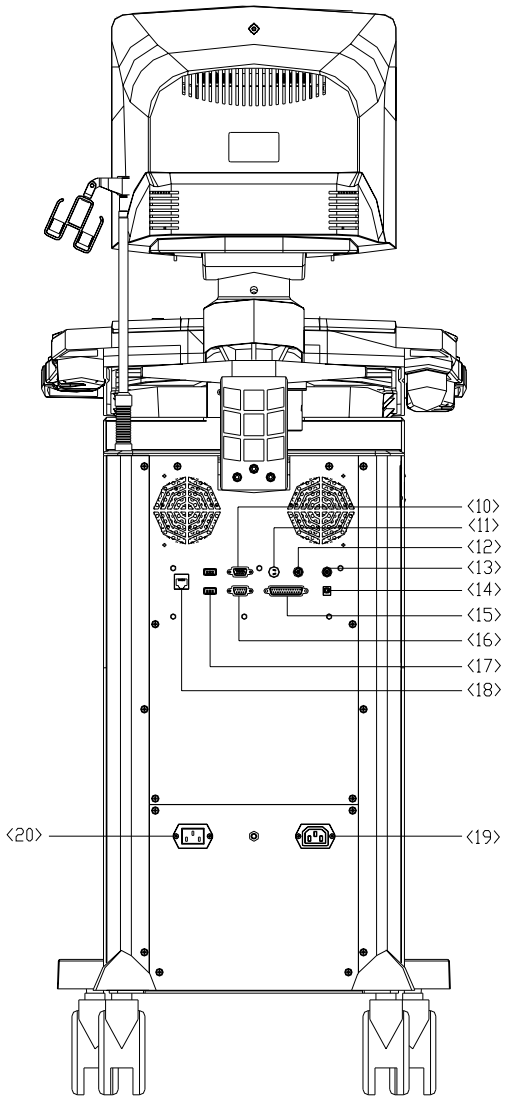
Front View



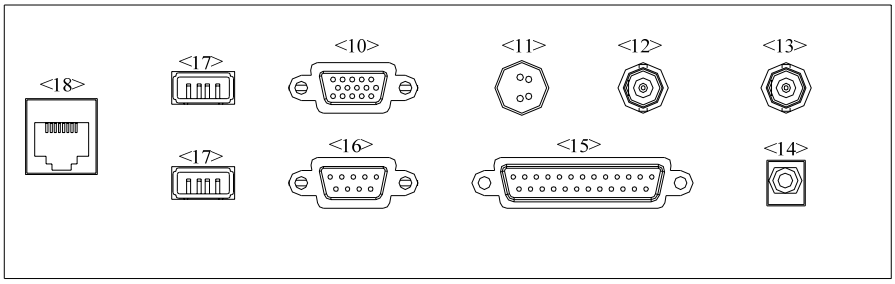
Left View

No.	Part	Introduction
<1>	Monitor	Display images and parameters, etc. 14″ monitor
<2>	Transducer cable hanger	Hook for the transducer cable
<3>	Transducer holder	Place the transducer provisionally
<4>	Transducer socket	Connect or disconnect the transducer with the main unit
<5>	Footswitch socket	Connect or disconnect footswitch
<6>	Control panel	User interface
<7>	Handle	Move the system
<8>	CD-RW	Backup the data in hard disk or USB storage device into a CD, or read out the files from a CD.
<9>	Power switch	Power on / off

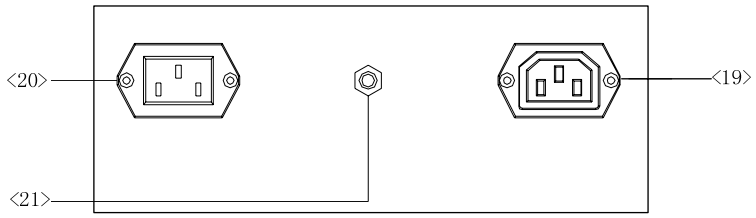
1.2.2.Rear Panel



Rear View



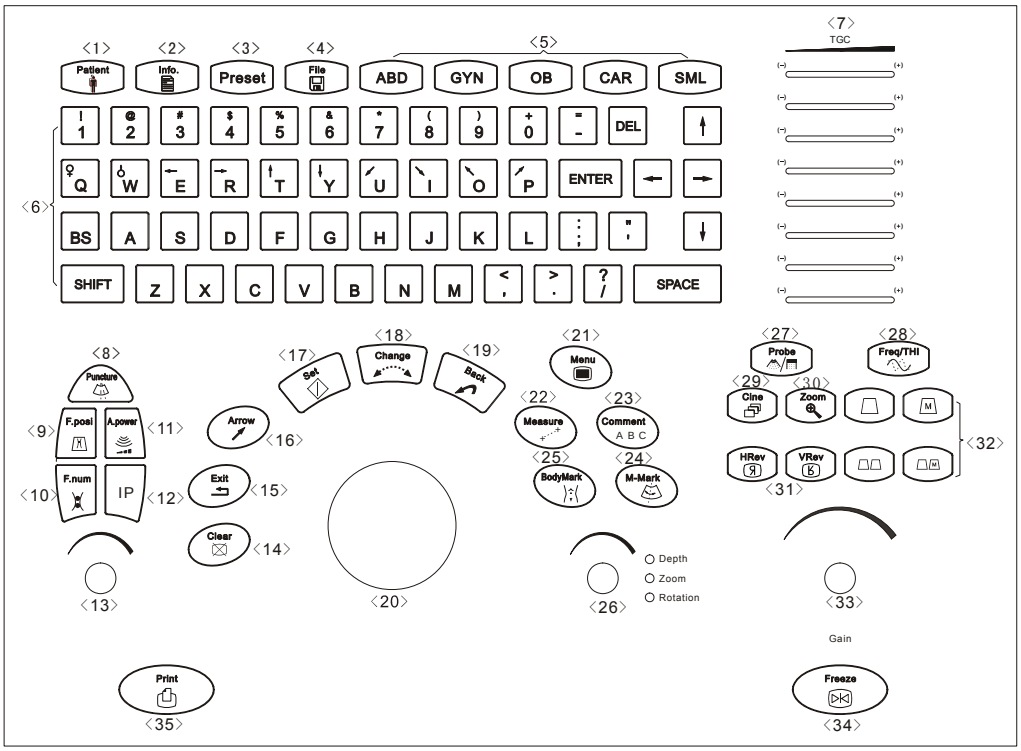
I/O Panel



Power Panel

No.	Name	Introduction
<10>	VGA port	VGA output
<11>	S-Video port	Video output
<12>	Video output	Connects a video printer
<13>	Video output	Connects a video printer
<14>	Remote	Connects the remote cable for the video printer
<15>	Graph/text printer port	Connects the parallel port of the Graph/text printer
<16>	RS-232 port	Reserved
<17>	USB port	Connects the USB storage device or graph/text printer, etc.
<18>	Ethernet port	Connects network
<19>	AC out	Connects the power cable of video printer
<20>	AC input	Connects power cable for the system
<21>	Equipotential terminal	Equipotential connecting

1.2.3.Control Panel



Control Panel

NO.	Key	Function
<1>	Patient	Delete the data for the previous patient, including the ID and measured values, and begin with a new patient.
<2>	Info	The patient information screen appears.
<3>	Preset	Invoke the registered initial settings (presets).
<4>	File	Activate the stored or loaded file system
<5>	ABD/GYN/OB/CAR/SML	Select the exam mode
<6>	Character Key	Used to enter characters and symbols When the backlight indicator of SHIFT key is on, the symbols on the upper row of the keys can be entered.
<7>	TGC	Adjust the ultrasound echo reception sensitivity according to the depth.
<8>	Puncture	Enter/exit the biopsy status
<9>	F.Posi	Adjust the focus position.
<10>	F.Num	Adjust the focus number.
<11>	A.power	Adjust the acoustic power

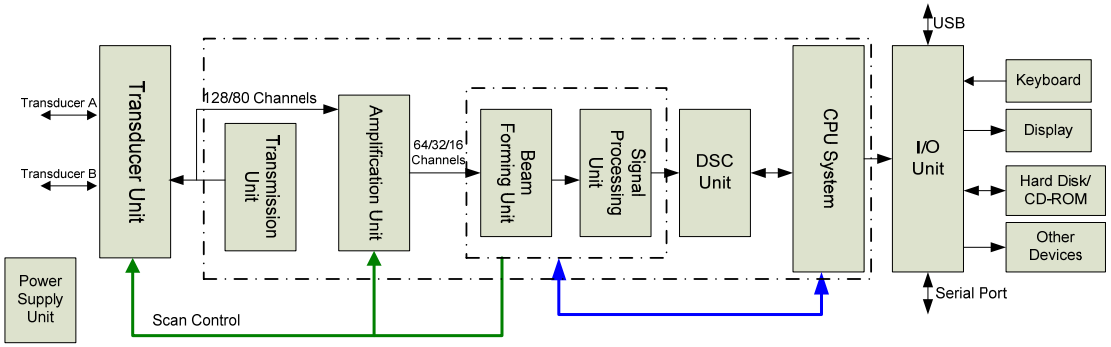
NO.	Key	Function
<12>	IP	Select the combination of image processing parameters, to adjust the image display effect.
<13>	Parameter adjust knob	Adjust some value of Puncture, F.Posi, F.Num, A.Power and IP with combination of corresponding key.
<14>	Clear	Clear all comments, bodymarks, measurement scales and general measurement results on the screen
<15>	Exit	Exit the current work mode
<16>	Arrow	Enter the arrow comment mode
<17>	Set	Determine the cursor position for measurement, and confirm the selected items, and adjust the value or items in menus etc.
<18>	Change	Switch between the fixed end and active end in the measurement.
<19>	Back	Delete the arrow comment or return to the previous operation, and adjust the value or items in menus etc.
<20>	Trackball	Move the cursor or mark during image movement or measurement.
<21>	Menu	Open or close the menu on the screen.
<22>	Measure	Enter/exit the measurement mode
<23>	Comment	Enter/exit the comment mode
<24>	M-Mark	Enter/exit the M-Mark mode
<25>	BodyMark	Enter/exit the BodyMark mode.
<26>	Depth/Zoom/Rotation	Adjust the viewing depth for display, the zoom mode, and the arrow rotation of the ultrasound images.
<27>	Probe	Switch transducers
<28>	Freq/THI	Adjust the transducer frequency and switch to the harmonic frequency of 35C50HA.
<29>	Cine	Enter the manual playback mode.
<30>	Zoom	Enter the mode of amplifying the image
<31>	HRev / VRev	Reverse the image horizontally or vertically
<32>	B/M/M+B/B+B	Select the image mode
<33>	Gain	Adjust the sensitivity of black/white images.
<34>	Freeze	Freeze or unfreeze the image. If an image is frozen, the output of acoustic power is stopped.
<35>	Print	Activate the printing function for the video printer connected.

Chapter 2 Hardware Introduction

2.1. Hardware System

The hardware system consists of the transducer unit, tranmission unit, amplification unit, beam forming unit, B/M signal processing unit, DSC unit, CPU system, I/O unit and power supply unit.

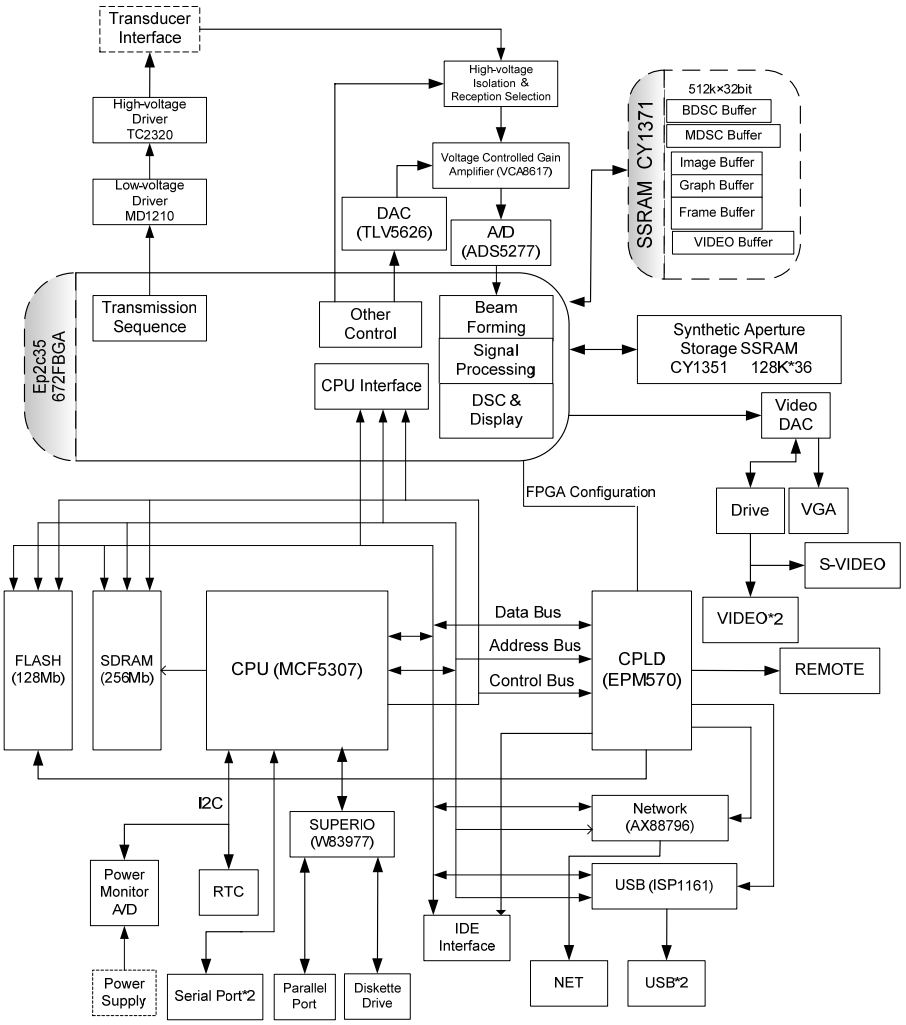
The hardware system is shown as the figure below.



2.2. Boards

2.2.1. Main Board

The diagram of the main board is shown as follows.

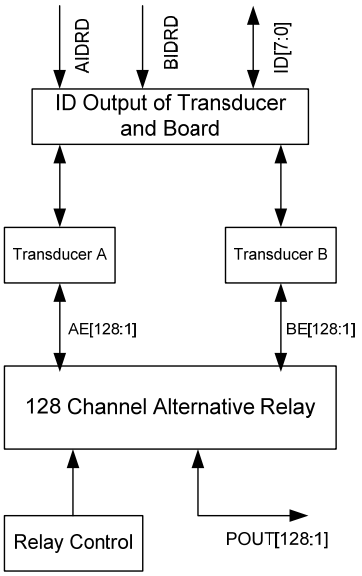


The front-end transmission circuit consists of MD1210 and TC2320. The reception circuit includes ADG714, VCA8617 and ADS5277. The transmission sequence control and reception channel selection are completed by FPGA.

The digital circuit consists of the CPU system and the FPGA system. The CPU system includes CPU and the peripheral and interface circuit: FLASH, SDRAM, CPLD, power monitor (ADT7462), reset circuit, clock circuit, real-time clock circuit (MAX6900), IDE interface, USB interface, and Ethernet interface; The FPGA system includes FPGA, beam forming SSRAM, DSC and display SSRAM, DAC conversion circuit and video interface; CPU is connected to the peripheral and interface circuit with bus and also to FPGA with bus; The signal processing is performed in FPGA.

2.2.2. Transducer Board

The diagram of the transducer board is shown as follows.

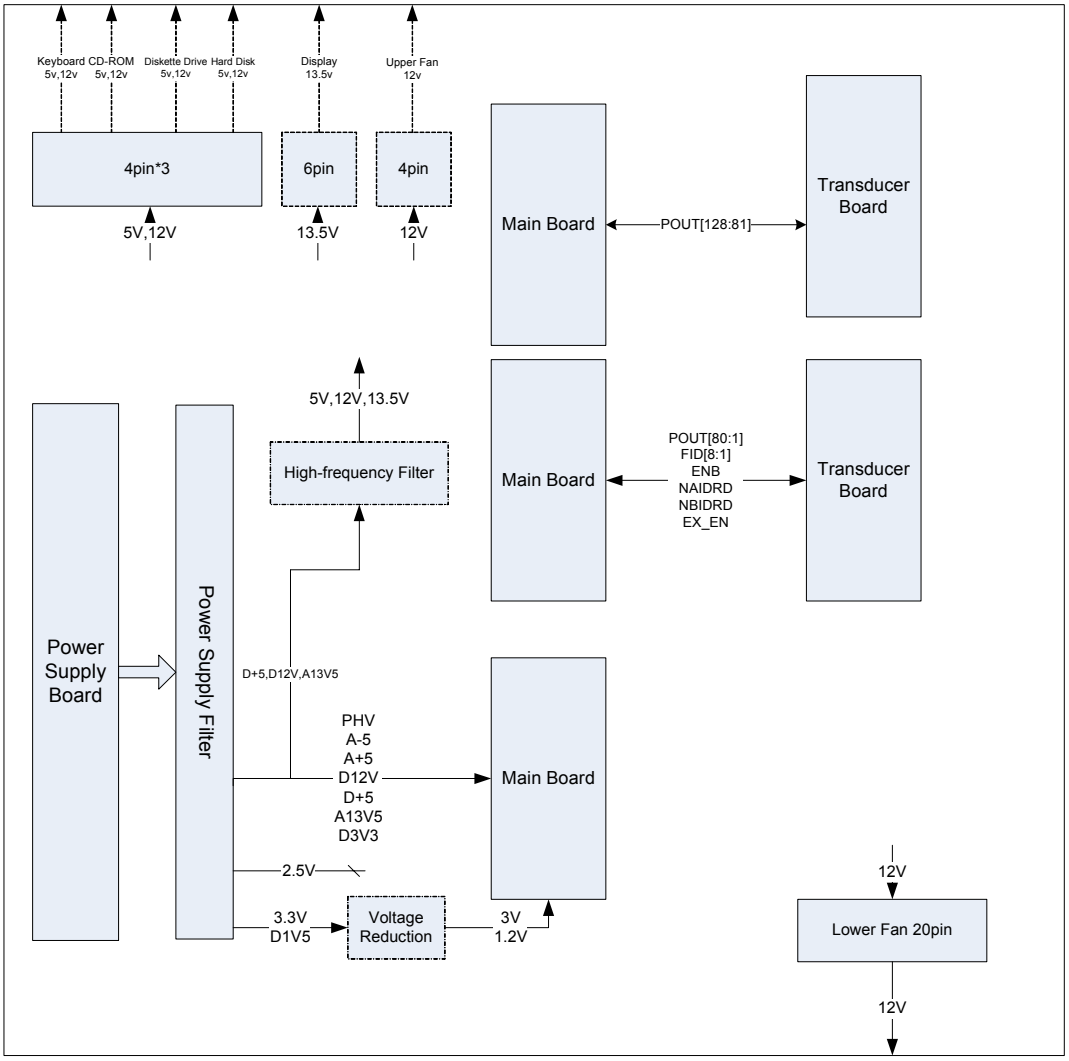


The transducer board consists of transducer sockets A and B, 128 channel alternative relay, transducer and board ID output circuit, relay control circuit and power filter circuit.

2.2.3.Connection Board

The connection board provides connection platform for the main board, transducer board, power supply board, keyboard, fans, peripherals and output interfaces and is convenient for tests of input and output signals on boards. The board, which is grounded well and conforms to the requirements of EMC, can filter differential mode and common mode noise. DP-9900, DP-9900Plus and DP-8800Plus all use the board.

The diagram of the connection board is shown as follows.



2.2.3.1. Interfaces to Power Supply Board

The interfaces between the connection board and the power supply board are defined in the table below.

		A	B	C
P1	**1**	PHV	PHV	PHV
	2	NC	NC	NC
	3	GND	GND	GND
	4	A-5	A-5	A-5
	5	GND	GND	GND
	6	12V	12V	12V
	7	GND	GND	GND

8	A+5	A+5	A+5
9	A+5	A+5	A+5
10	A+5	A+5	A+5
11	GND	GND	GND
12	HVC	GND	GND
13	GND	GND	GND
14	GND	GND	GND
15	2V5	2V5	2V5
16	GND	GND	GND
17	1V5	1V5	1V5
18	1V5	1V5	1V5
19	GND	GND	GND
20	GND	GND	GND
21	3V3	3V3	3V3
22	3V3	3V3	3V3
23	GND	GND	GND
24	GND	GND	GND
25	13V5	13V5	13V5
26	NC	GND	GND
27	NC	GND	NC
28	GND	GND	GND
29	NC	GND	NC
30	GND	GND	GND
31	D+5	D+5	D+5
32	D+5	D+5	D+5

2.2.3.2. Interfaces to Main Board

The interfaces between the connection board and the main board are defined in the table below.

		A	**B**	**C**	**D**	**E**
P2	**1**	HV	HV	HV	HV	HV
	2	GND	GND	GND	GND	GND
	3	FA-5	FA-5	FA-5	FA-5	FA-5
	4	GND	GND	GND	GND	12V
	5	GND	GND	GND	GND	GND
	6	FA+5	FA+5	FA+5	FA+5	FA+5

	7	FA+5	FA+5	FA+5	FA+5	FA+5
	8	GND	GND	GND	GND	GND
	9	GND	GND	GND	GND	HVC
	10	FA3V	FA3V	FA3V	FA3V	FA3V
	11	GND	GND	GND	GND	GND
	12	GND	GND	GND	GND	GND
	13	GND	GND	GND	GND	GND
	14	F1V2	F1V2	F1V2	F1V2	F1V2
	15	F1V2	F1V2	F1V2	F1V2	F1V2
	16	GND	GND	GND	GND	GND
	17	FD3V3	FD3V3	FD3V3	FD3V3	FD3V3
	18	FD3V3	FD3V3	FD3V3	FD3V3	FD3V3
	19	13V5	GND	GND	GND	GND
	20	GND	GND	GND	GND	GND
	21	FD+5	FD+5	FD+5	FD+5	FD+5
	22	FD+5	FD+5	FD+5	FD+5	FD+5
P3	**1**	GND	POUT92	POUT90	POUT89	POUT96
	2	POUT86	GND	POUT91	POUT112	POUT94
	3	POUT95	POUT88	GND	POUT85	POUT110
	4	POUT93	POUT82	POUT81	GND	POUT87
	5	POUT98	POUT84	POUT109	POUT83	GND
	6	GND	POUT100	POUT106	POUT108	POUT111
	7	POUT99	GND	POUT102	POUT107	POUT105
	8	POUT97	POUT104	GND	POUT101	POUT126
	9	POUT121	POUT103	POUT122	GND	POUT128
	10	POUT125	POUT127	POUT123	POUT124	GND
	11	GND	POUT119	POUT120	POUT117	POUT118
	12	POUT114	GND	POUT113	POUT116	POUT115
	13	GND	GND	GND	GND	GND
	14	ENB	FID1	FID2	FID3	FID4
	15	FID5	FID6	FID7	FID8	GND
	16	/AIDRD	/BIDRD	GND	GND	GND
	17	GND	GND	GND	GND	GND
	18	GND	GND	GND	GND	GND
	19	GND	GND	GND	GND	GND

	20	GND	GND	GND	GND	GND
	21	GND	GND	GND	GND	GND
	22	GND	GND	GND	GND	GND
P4	**1**	GND	GND	GND	GND	GND
	2	GND	GND	GND	GND	GND
	3	GND	POUT2	POUT15	POUT14	POUT16
	4	POUT4	GND	POUT13	POUT11	POUT12
	5	POUT1	POUT10	GND	POUT6	POUT9
	6	POUT3	POUT7	POUT8	GND	POUT5
	7	POUT22	POUT25	POUT28	POUT26	GND
	8	GND	POUT19	POUT20	POUT24	POUT27
	9	POUT31	GND	POUT21	POUT32	POUT30
	10	POUT29	POUT18	GND	POUT23	POUT48
	11	POUT34	POUT45	POUT17	GND	POUT46
	12	POUT36	POUT42	POUT47	POUT41	GND
	13	GND	POUT33	POUT40	POUT44	POUT43
	14	POUT35	GND	POUT39	POUT38	POUT37
	15	POUT58	POUT60	GND	POUT64	POUT62
	16	POUT63	POUT54	POUT57	GND	POUT80
	17	POUT61	POUT56	POUT59	POUT78	GND
	18	GND	POUT66	POUT53	POUT52	POUT55
	19	POUT68	GND	POUT51	POUT50	POUT49
	20	POUT77	POUT79	GND	POUT73	POUT74
	21	POUT65	POUT69	POUT75	GND	POUT76
	22	POUT67	POUT71	POUT72	POUT70	GND

2.2.3.3. Interfaces to Transducer Board

The interfaces between the connection board and the transducer board are defined in the table below.

		A	**B**	**C**	**D**	**E**
P5	**1**	GND	POUT92	POUT90	POUT89	POUT96
	2	POUT86	GND	POUT91	POUT112	POUT94
	3	POUT95	POUT88	GND	POUT85	POUT110
	4	POUT93	POUT82	POUT81	GND	POUT87
	5	POUT98	POUT84	POUT109	POUT83	GND
	6	GND	POUT100	POUT106	POUT108	POUT111

	7	POUT99	GND	POUT102	POUT107	POUT105
	8	POUT97	POUT104	GND	POUT101	POUT126
	9	POUT121	POUT103	POUT122	GND	POUT128
	10	POUT125	POUT127	POUT123	POUT124	GND
	11	GND	POUT119	POUT120	POUT117	POUT118
	12	POUT114	GND	POUT113	POUT116	POUT115
	13	GND	GND	GND	GND	GND
	14	ENB	FID1	FID2	FID3	FID4
	15	FID5	FID6	FID7	FID8	GND
	16	/AIDRD	/BIDRD	GND	GND	GND
	17	GND	GND	GND	GND	GND
	18	A+5	A+5	A+5	A+5	A+5
	19	GND	GND	GND	GND	GND
	20	GND	GND	GND	GND	GND
	21	GND	GND	GND	GND	GND
	22	GND	GND	GND	GND	GND
P6	**1**	GND	GND	GND	GND	GND
	2	GND	GND	GND	GND	GND
	3	GND	POUT2	POUT15	POUT14	POUT16
	4	POUT4	GND	POUT13	POUT11	POUT12
	5	POUT1	POUT10	GND	POUT6	POUT9
	6	POUT3	POUT7	POUT8	GND	POUT5
	7	POUT22	POUT25	POUT28	POUT26	GND
	8	GND	POUT19	POUT20	POUT24	POUT27
	9	POUT31	GND	POUT21	POUT32	POUT30
	10	POUT29	POUT18	GND	POUT23	POUT48
	11	POUT34	POUT45	POUT17	GND	POUT46
	12	POUT36	POUT42	POUT47	POUT41	GND
	13	GND	POUT33	POUT40	POUT44	POUT43
	14	POUT35	GND	POUT39	POUT38	POUT37
	15	POUT58	POUT60	GND	POUT64	POUT62
	16	POUT63	POUT54	POUT57	GND	POUT80
	17	POUT61	POUT56	POUT59	POUT78	GND
	18	GND	POUT66	POUT53	POUT52	POUT55
	19	POUT68	GND	POUT51	POUT50	POUT49

	20	POUT77	POUT79	A+5	POUT73	POUT74
	21	POUT65	POUT69	POUT75	A+5	POUT76
	22	POUT67	POUT71	POUT72	POUT70	A+5

2.2.3.4. Interfaces to Peripherals

The connection board provides power supply for all peripherals, which includes the display, hard disk, CD-ROM, keyboard and fans.

- J5, the interface between the connection board and display, is defined as the table below.

Pin	1	2	3	4	5	6
Signal	13.5v	NC	13.5v	GND	NC	GND

- J2, J3 and J4, the interfaces between the connection board and the hard disk, CD-ROM and keyboard, is defined as the table below.

Pin	1	2	3	4
Signal	GND	GND	5v	12v

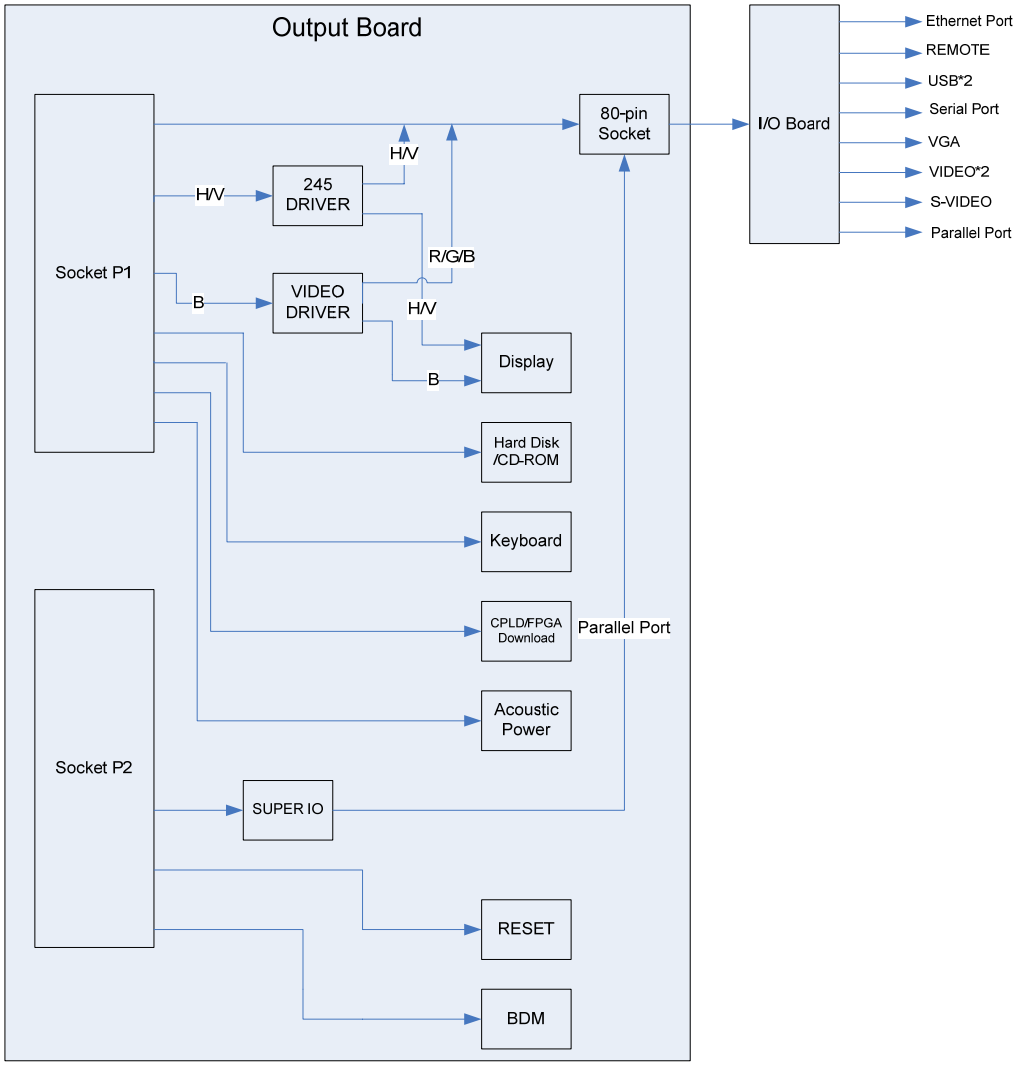
- J1, the interface between the connection board and fans, is defined as the table below.

Pin	1	2	3	4
Signal	12v	12v	GND	GND

2.2.4.Output Board

The output board, connected to the main board, provides signal path to peripherals and download interface for the main board. It locates in the outmost part of the cabinet. It is grounded well and accordance with the requirements of EMC and can filter differential mode and common mode noise.

The diagram of the output board is shown as follows.



The interfaces between the output board and the main board are defined in the tables below.

CT7	TPOP	TPON	TPIP	TPIN	
GND	GND	GND	GND	GND	
IDE_RST	IDE_D0	IDE_D1	IDE_D2	IDE_D3	
GND	IDE_D4	IDE_D5	IDE_D6	GND	
IDE_D10	IDE_D7	IDE_D8	GND	IDE_D9	
IDE_D14	GND	IDE_D11	IDE_D12	IDE_D13	P1
GND	IDE_D15	GND	IDE_NIOW	IDE_NIOR	
IDE_NDMACK	GND	IDE_IORDY	IDE_ALE	GND	
GND	IDE_IRQ	IDE_DA2	GND	IDE_DA0	
IDE_NCS1FX	IDE_NCS3FX	GND	IDE_DA1	IDE_NDASP	
GND	GND	VIEDO1	GND	GND	

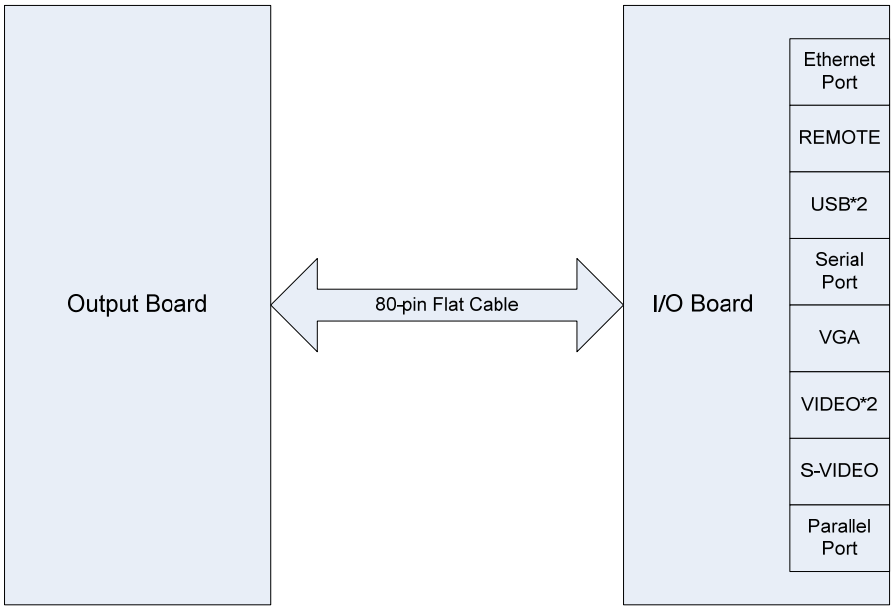
VP_BUSY	VP_NPRT	GND	VIDEO2	VIDEO3	
GND	GND	BLUE	GND	GND	
GND	VGA_NHSYNC	GND	VGA_NVSYNC	D3.3V	
USB1_POWER	GND	USB_DP1	GND	D3.3V	
USB2_POWER	USB_DM1	USB_DM2	USB_DP2	GND	
GND	GND	GND	GND	RATE_TP	
RXD2	CTS1	RTS1	TXD2	GND	
GND	GND	GND	GND	FRAME_TP	
KEY_RXD	KEY_TXD	GND	NC	NC	
GND	CPLD_TDO	FPGA_TDI	FPGA_TMS	FPGA_TCK	
GND	GND	GND	GND	NC	

P_NIOR	GND	PA0	GND	A-5	P2
GND	PD24	GND	GND	A-5	
P_NIOW	GND	PA1	GND	GND	
GND	PD25	GND	PA3	GND	
P_AEN	GND	PA2	GND	PA4	
GND	PD26	GND	PA6	GND	
P_IO_RST	GND	PA5	GND	PA7	
GND	PD27	GND	PA9	GND	
FDC_IRQ	GND	PA8	GND	PA10	
GND	PD28	GND	PA12	GND	
COM1_IRQ	GND	PA11	GND	PA13	
GND	PD29	GND	PA14	GND	
N_MRST	GND	PD31	GND	PA15	
GND	PD30	GND	NC	GND	
MRST_REF	GND	NTA	GND	NC	
GND	NBDM_RST	GND	NBKPT	GND	
PST0	GND	PST2	GND	PST3	
GND	PST1	GND	DSCLK	GND	
DSI	DSO	GND	GND	PSTCLK	
GND	GND	NC	GND	GND	
D+5	GND	GND	GND	GND	
D+5	D+5	D+5	D+5	D+5	

2.2.5.I/O Board

The I/O board, communicating with the output board through the 80-pin flat cable, provides interfaces for all peripherals, such as the Ethernet port, serial port, parallel port, VGA, REMOTE, S-VIDEO, USBs and VIDEOs. (Note: The I/O board of DP-8800 has no REMOTE and only one VIDEO.)

The diagram of the I/O board is shown as follows.



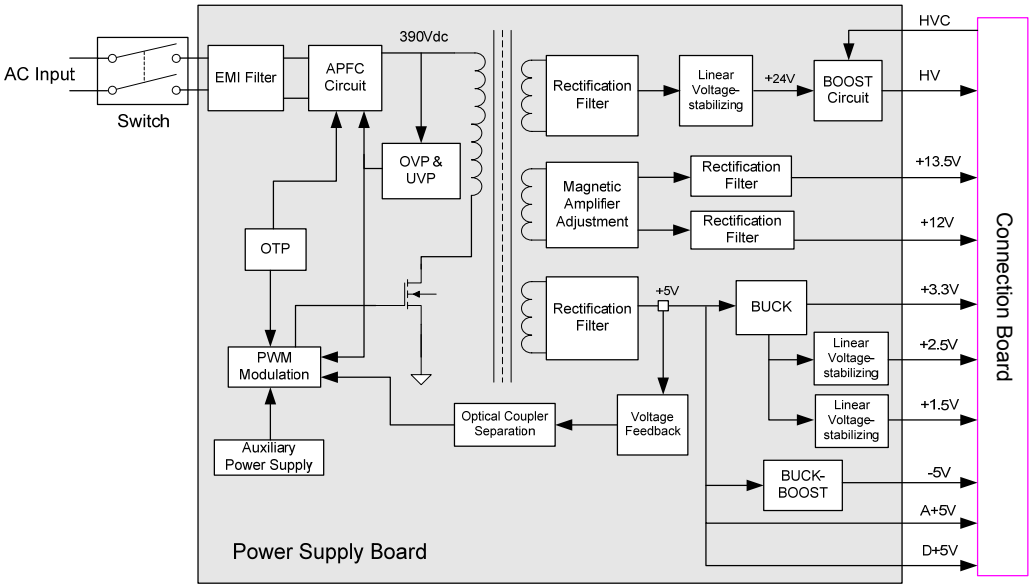
2.3. Power Supply Board

2.3.1.Introduction

The power supply board provides +5V (D+5V and A+5V), +12V, +13.5V, +3.3V, -5V, +1.5V, +2.5V and program-controlled high voltage for the system.

The connection board connects the power supply board, main board and transducer board, filters output voltage, and performs the linear voltage-stabilizing from +3.3V to +3V and from +1.5 to +1.2V. The filter circuit is π-type.

The diagram of the power supply board is shown as follows.



2.3.2.Working Procedure

The AC input passes the EMI filter circuit and then the BOOST PFC circuit to be converted to DC 370-410V. It then be converted to +5V, +13.5V, +12V and +24V outputs by the two-transistor forward converter. The +5V output is the main feedback output of the converter and others are auxiliary outputs of the converter. To obtain appropriate voltage and load adjustment ratio, +13.5V and +12V are adjusted by the magnetic amplifier and +24V is stabilized linearly. +5V is output directly as well as works as the input of +3.3V and -5V. +24V is converted to the HV output by BOOST.

+5V, -5V, +13.5V and HV have the overvoltage and overcurrent protection. When the protection takes effect for +5V, the whole power supply board stops outputting; When the protection takes effect for -5V and HV, only -5V and HV are stopped outputting; When the protection takes effect for +13.5V, +5V is not affected.

The power supply board also has the overtemperature protection function, which prevents temperature of key power devices such as the transformer and MOSFET from exceeding safe range when the system malfunctions.

2.3.3.Circuit Description

The PFC circuit uses the control chip UC3854 from TI company and BOOST converter controlled with average current mode. It also uses IRFPC60LC (600V/16A) from IR company as the main switch tube and ISL9RL1560G2 (600V/15A) from FAIRCHILD company as the follow current tube.

The control chip U8 of the FORWARD converter is the voltage control chip MB3769A from FUJITSU company, which can adjust voltage, limit current cycle by cycle, and has built-in functions of soft start, low-voltage lock and protection lock. The transformer T1 not only transforms voltage but meets requirements of safe isolation. The switch tube is SPA06N60C3

from INFINEON company, which basic parameter is 650V/6.2A. The +5V output is the main feedback output of the FORWARD converter, +13.5V and +12V are adjusted by the magnetic amplifier, and +24V is stabilized linearly by LM317.

HV is output from the BOOST converter, which uses the voltage control chip TL594 from ONSEMI company. HV is controlled by 0-4V analog input signal and varies linearly between 30V and 140V with the variation of control signal.

+3.3V is output from the BUCK converter which is based on synchronous rectification. EL7566 from INTERSIL company works as the controller, which integrates all control and protection circuits and switch tube. Its rated output current is 6Amp and its conversion efficiency can reach 96% at most.

+2.5V and +1.5V are the outputs of +3.3V after linear voltage-stabilizing, which is performed by IRF7401 MOS from IR company and feedback control circuit. The MOS works at the amplification area to realize linear stabilizing of low voltage.

-5V is obtained from +5V through BUCK-BOOST converter, which uses the control chip TPS6755 from TI company. The chip, integrating MOS, produces negative voltage output along with external inductors, capacitors and diodes and have current limit protection for switch tube.

2.3.4.Protection Circuit

The power supply board has following protection functions: PFC output overvoltage protection, output overvoltage protection, overtemperature protection, +5V/+12V/+13.5V/-5V/HV output overvoltage/overcurrent/short-circuit protection, and other short-circuit protections.

1. When PFC output overvoltage protection, overtemperature protection or +5V output overvoltage/overcurrent/short-circuit protection works, the whole power supply board stops all outputs and locks. The board does not work until the system recovers from the failure and restarts.

2. When +13.5V output overvoltage/overcurrent/short-circuit protection works, +13.5V and HV outputs stop and keep locking. +13.5V and HV cannot be output until the failure is removed and the +13.5V/+12V output load is disconnected.

3. When +12V output overvoltage/overcurrent/short-circuit protection works, the output stops and keeps locking. The +12V cannot be output until the failure is removed and the +13.5V/+12V output load is disconnected.

4. When +3.3V short-circuit protection works, +3.3V and HV outputs stop. They can recover automatically after the failure is removed.

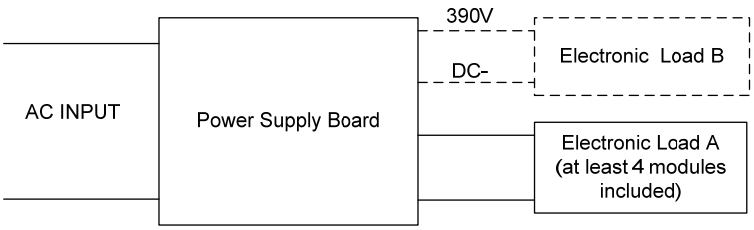
5. When -5V overcurrent/short-circuit protection works, -5V output stops. When -5V overvoltage protection works, the output stabilizes at some voltage (>-7V) exceeding the rated voltage, not affecting other outputs, and can recover automatically after the failure is removed.

6. When HV overvoltage/overcurrent/short-circuit protection or +1.5V/+2.5V

overcurrent/short-circuit protection works, the output stops and does not affect other outputs. They except HV can recover automatically after the failure is removed.

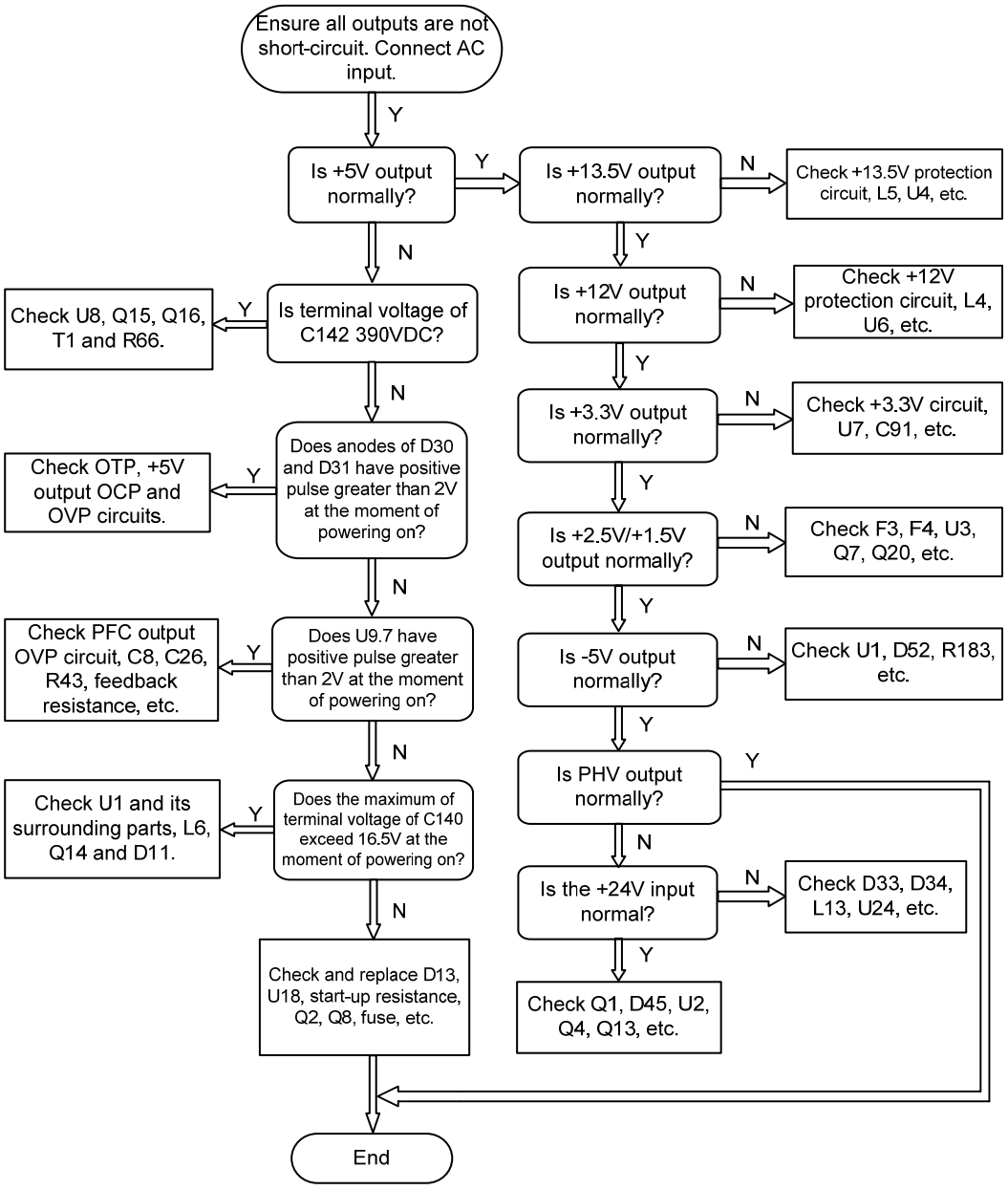
2.3.5.Maintenance

Before test or service, connect the power supply board as the figure below shows. The electronic load A is necessary while the electronic load B is not. When adding the electronic load B, ensure the load for 390VDC does not exceed 0.1A and is added only when loads for other outputs are minimum.

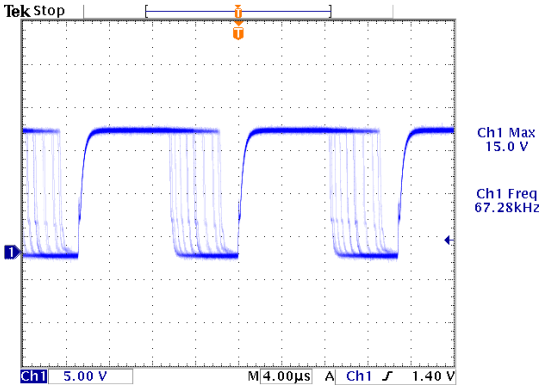


You can add loads only for +5V, +13.5V, +12V and HV outputs. It is recommended to start debugging when the load is a little heavier than the minimum and to increase the load during the debug if necessary.

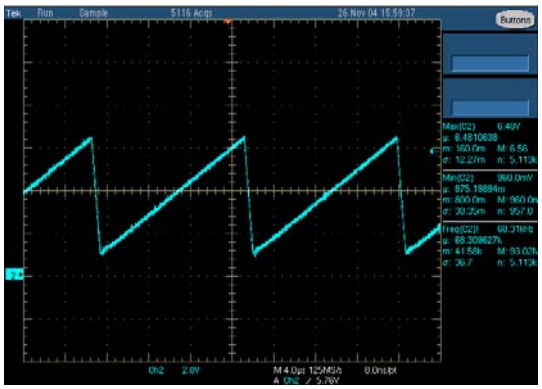
After connecting the board properly, you can locate the failure and service the board according to the procedure shown in the figure below. The following procedure is just a basic instruction and you should operate according to the actual situation.


Ensure all outputs are not short-circuit. Connect AC input.
Y
Is +5V output normally?
Y
Is +13.5V output normally?
N
Check +13.5V protection circuit, L5, U4, etc.
N
Y
Is +12V output normally?
N
Check +12V protection circuit, L4, U6, etc.
Y
Is +3.3V output normally?
N
Check +3.3V circuit, U7, C91, etc.
Y
Is +2.5V/+1.5V output normally?
N
Check F3, F4, U3, Q7, Q20, etc.
Y
Is -5V output normally?
N
Check U1, D52, R183, etc.
Y
Is PHV output normally?
Y
N
Is the +24V input normal?
N
Check D33, D34, L13, U24, etc.
Y
Check Q1, D45, U2, Q4, Q13, etc.
Y
Is terminal voltage of C142 390VDC?
Y
Check U8, Q15, Q16, T1 and R66.
N
Does anodes of D30 and D31 have positive pulse greater than 2V at the moment of powering on?
Y
Check OTP, +5V output OCP and OVP circuits.
N
Does U9.7 have positive pulse greater than 2V at the moment of powering on?
Y
Check PFC output OVP circuit, C8, C26, R43, feedback resistance, etc.
N
Does the maximum of terminal voltage of C140 exceed 16.5V at the moment of powering on?
Y
Check U1 and its surrounding parts, L6, Q14 and D11.
N
Check and replace D13, U18, start-up resistance, Q2, Q8, fuse, etc.
End

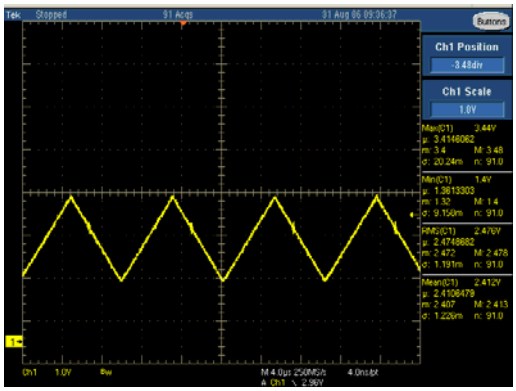
The following figures shows some waveforms which can be referred during the test and service.



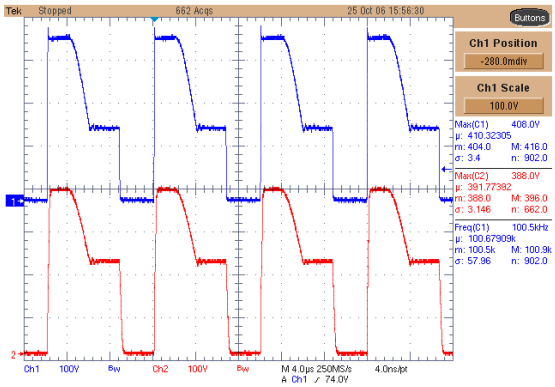
GS Voltage Waveform of Q14



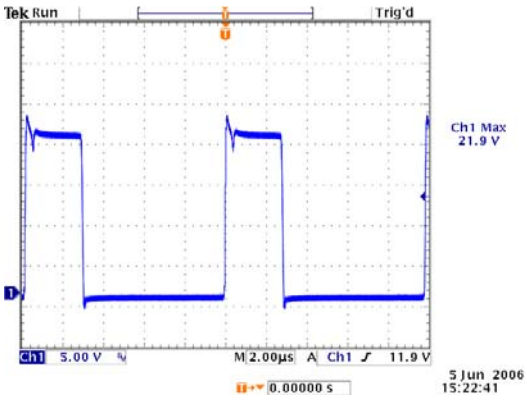
Oscillation Waveform of Pin 14 of U18



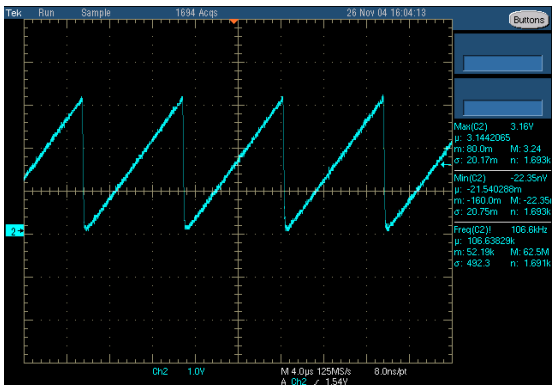
Oscillation Waveform of Pin 5 of U8



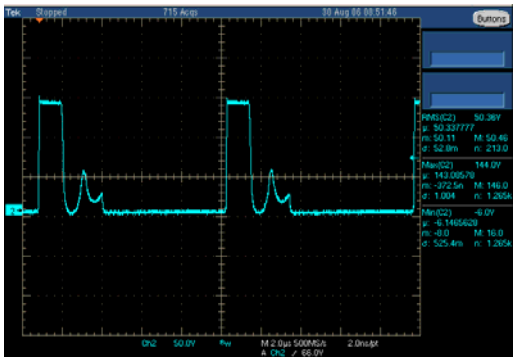
DS Voltage Waveform of Q15 and Q16



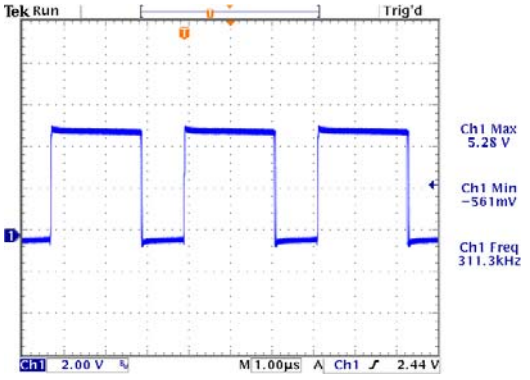
Voltage Waveform of D1



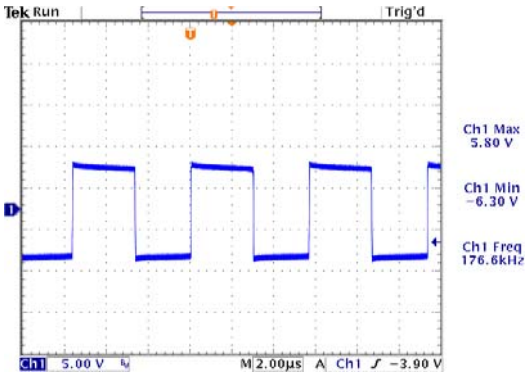
Oscillation Waveform of Pin 5 of U2



DS Voltage Waveform of Q1



Voltage Waveform of U7.8



Voltage Waveform of U1.7

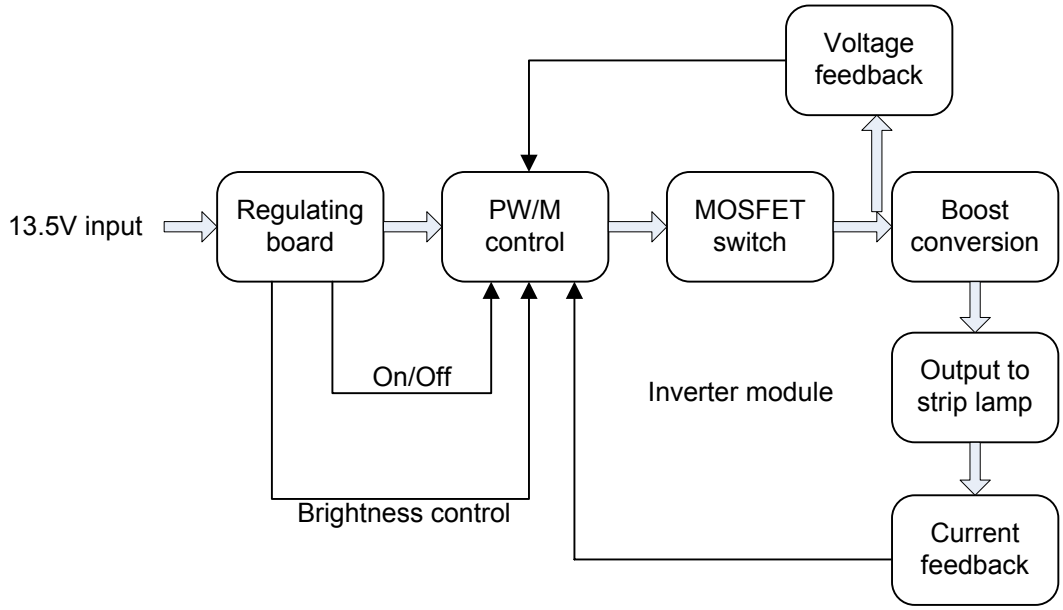
In the figure of GS Voltage Waveform of Q14, the duty ratio of drive waveform varies with the AC input voltage. In the figure of DS Voltage Waveform of Q1, the amplitude of switch waveform varies with the HV output. Besides the two waveforms describes before, the amplitude, frequency and duty ratio of all waveforms tested during the service must be the same with the figures above.

⚠ Warning: Take extreme caution when testing and servicing boards to avoid damage of measurement devices and boards and even body injury. Never touch any parts on boards especially the primary circuit and the high voltage part of secondary circuit.

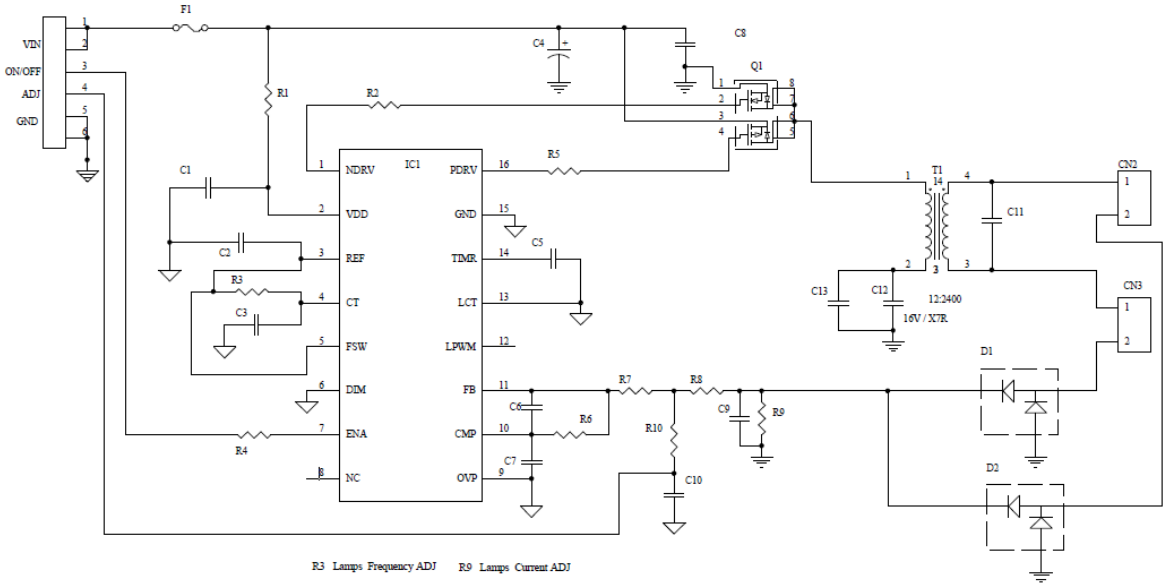
2.4. Principle of the LCD

2.4.1. Operating Principle of the Inverter Module

The block diagram and functional diagram are shown in the following figures.



Block Diagram of LCD Inverter



Functional Diagram of LCD Inverter

The input of the inverter module is a 13.5V DC from the regulating board. In the inverter module, the on-off MOSFETs are connected as a bridge circuit, which implements the on-off operations driven by the main IC and convert the input DC to high voltage AC and then transmit to the primary winding of the transformer. The secondary square wave of the transformer is converted to sine wave after LC resonance to drive the CCFL gives out light. The on-off signals control the on and off of the strip lamp throuth the enabling pin of the main IC. The brightness of the light is controlled by the brightness signal, which will control the duty cycle of square wave of main IC.

The inverter module is configured with protection circuit of open circuit, overvoltage and

overcurrent. Open circuit protection: When any of the strip lamps is open circuit, the current feedback signal will be severely weak. If the feedback current does not stabilize the CMP voltage even if the voltage of CMP rises to 3V, the IC will close two output pulses and the circuit is locked for protection. Over current protection: When the output current is too strong, the main IC will restrain the duty cycle of square wave after receiving the feedback signal from the strip lamp to lower the current for protection. Overvoltage protection: When the output voltage is too high, the main IC closes the PWM driving after receiving the feedback signal from the strip lamp for protection.

Definitions of the output ports of strip lamp driver CN2 and CN3:

Pin	Definition
1	Vout -H
2	Vout -L

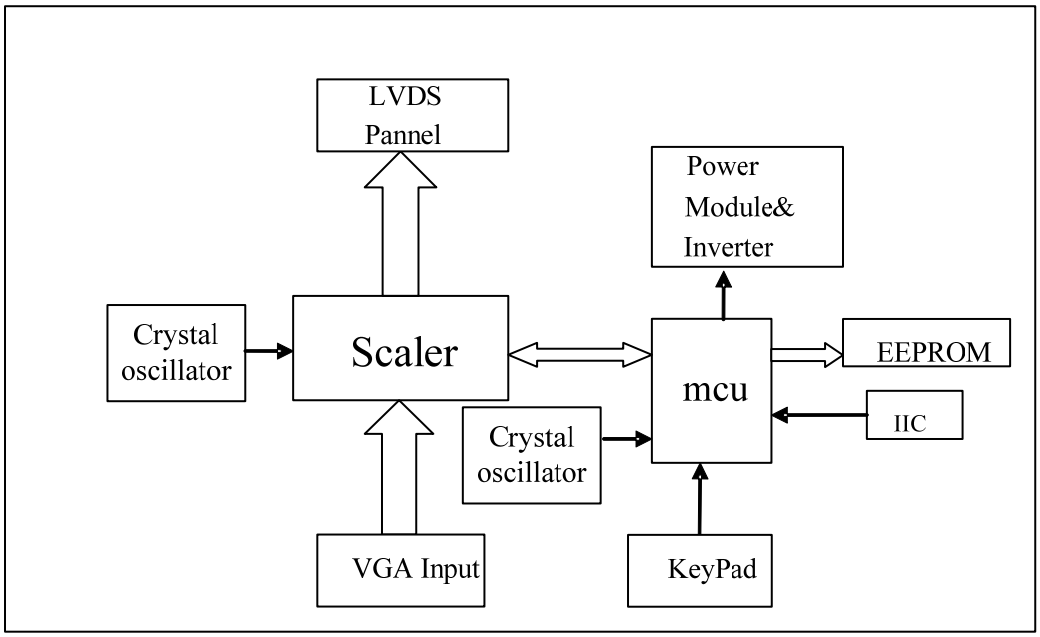
Definitions of the ports connected to CN1 and V/D board:

Pin	Definition
1	13.5V
2	13.5V
3	ON/OFF
4	ADJ
5	GND
6	GND

2.4.2.Working principle of the regulating board

The functional block diagram of the regulating board is shown in FIG 2-21.

The VGA signal is transmitted to RTD2620 and completes the identification, amplification and color processing. The signal is transformed to LVDS signal and then transmitted to the LCD screen. U6 (MTV412) is MCU, which is responsible for the control of RTD 2620 and control of external operations such as buttons. U1, U3 and U4 provide working voltage for DC-DC convert.



Functional Diagram of Regulating Board

The main ICs of different modules of the regulating board are shown below:

Pin	Type	Description
U1	LM2596-33	DC-DC conversion from 12V to 3.3V
U3	AMS1117 2.5	Conversion from 3.3V to 2.5V
U4	AIC1804-18PM	Conversion from 3.3V to 1.8V
U5	24C16	EEPROM
U6	MTV412	MCU
U7	RTD2620	Signal processing
U8	K4D263238I	GDDR
U9	4435	Panel Power On/Off
Y1/Y2	K24.000	Crystal Oscillator

Pin Definitions of LVDS Ports of the Regulating Board (J1)

Pin	Definition	Pin	Definition
1	GND	2	GND
3	RXOIN3+	4	RXOIN3-
5	GND	6	RXOCKIN+
7	RXOCKIN-	8	GND
9	RXOIN2+	10	RXOIN2-
11	GND	12	RXOIN1+
13	RXOIN1-	14	GND

15	RXOIN0+	16	RXOIN0-
17	GND	18	GND
19	PANEL_VCC	20	PANEL_VCC

Pin Definitions of Button Ports of the Regulating Board (J5)

Pin	Definition
1	R_LED
2	G_LED
3	AD0
4	AD1
5	GND
6	GND
7	12V
8	5V

Pin Definitions of Power Ports of the Regulating Board (J6)

Pin	Definition
1	ADJ（Backlight Adjust）
2	EN（Backlight　ON/Off）
3	GND
4	GND
5	13.5V
6	13.5V
7	NC

Pin Definitions of VGA Ports of the Regulating Board (J7)

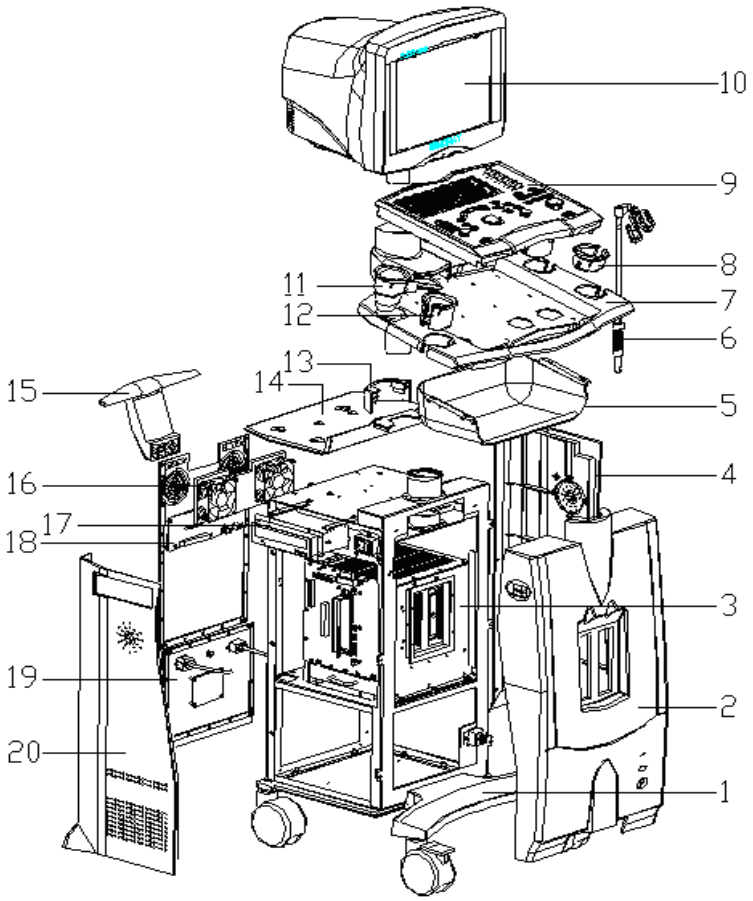
Pin	Definition	Pin	Definition
1	VSYNC	2	GND
3	HSYNC	4	GND
5	NC	6	NC
7	GREEN	8	GND
9	GND	10	GND

Pin Definitions of Power Ports of the Regulating Board (J8)

Pin	Definition
1	13.5V
2	13.5V
3	GND
4	GND

Chapter 3 Disassembly of DP-9900Plus/DP-9900

3.1. System Structure



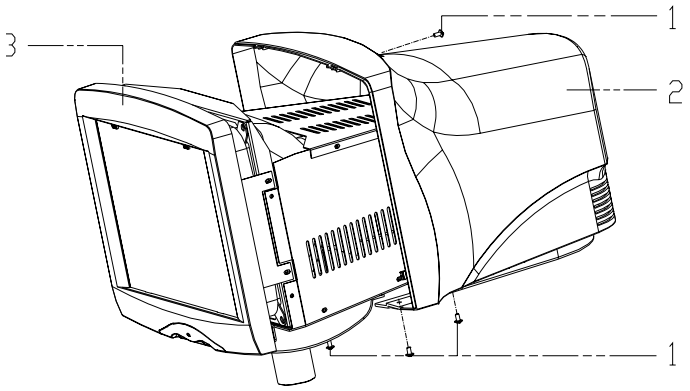
No.	Part No.	Name	No.	Part No.	Name
1	9906-20-71420	Framework	**11**	9901-21-23941	Couplant Holder
2	9901-20-23935-51	Front Cover	**12**	9901-21-23942	Transducer Holder B
3	9906-30-71433	Cabinet (9906)	**13**	9901-20-23940	Back Cover of Neck
	9905-30-71057	Cabinet (9905)			
4	9904-20-37005	Right Cover	**14**	9901-20-23939	Top Cover
5	2100-20-08052	Drawer	**15**	2102-20-17125	Handle
6	2102-30-16949	Transducer Cable Hanger	**16**	9906-30-71443	Air Outlet Fan Assembly
7	9901-30-23969	Keyboard Support	**17**	2131-30-71794	CD-ROM
8	9901-21-23942	Transducer Holder A	**18**	9906-30-71439	Upper Rear Cover
9	9905-30-71081	Keyboard (9905)	**19**	9906-30-71441	Lower Rear Cover
	9906-30-71512	Keyboard (9906)			

No.	Part No.	Name	No.	Part No.	Name
10	9904-30-37064	DP-9900Plus14" Monitor	**20**	9904-20-37004	Left Cover

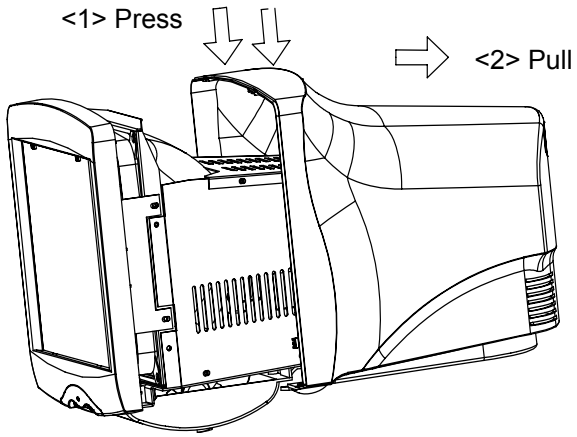
⚠ Warning: Be sure to disconnect the power supply before disassembling any part.

3.2. Disassembly of Monitor

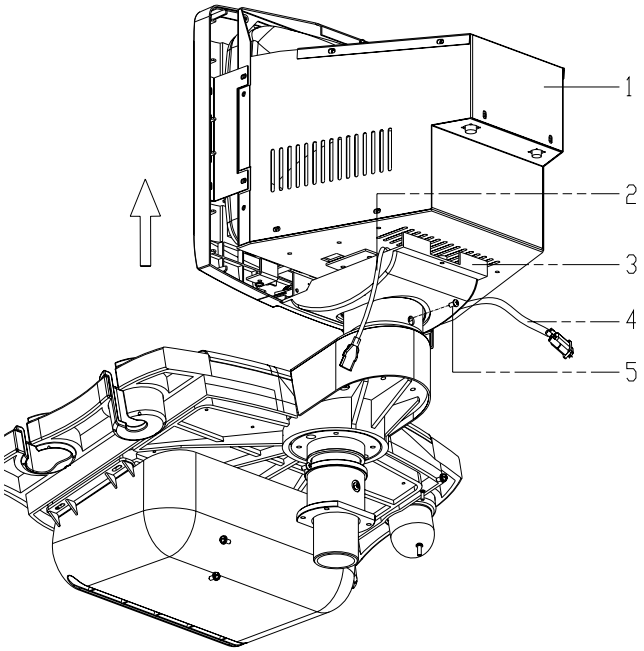
1. Remove the 4 M4×8 screws on the top and bottom of the monitor.
2. Release the swing bowl and let it stay around the neck.
3. Press the two clips with thumbs with two hands holding the sides of the monitor, and simultaneously pull the rear cover backwards.



1 - M4×8 Screws 2 - Rear Cover 3 - Monitor



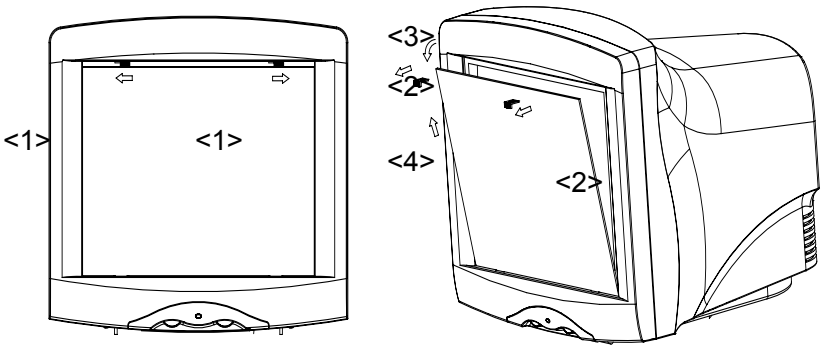
4. Disconnect the data line and the power cord from the monitor.
5. Remove the M5×16 screw on the bottom of the monitor.
6. Raise the monitor.



1 - Monitor 2 - Data Line 3 - Swing Bowl 4 - Power Cord 5 - M5×16 Screw

3.3. Disassembly of Screen

1. Slide the two clips and pull them out.

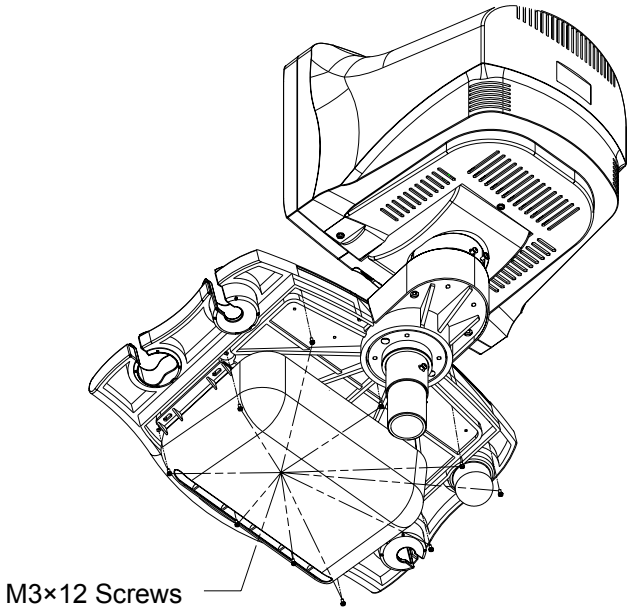


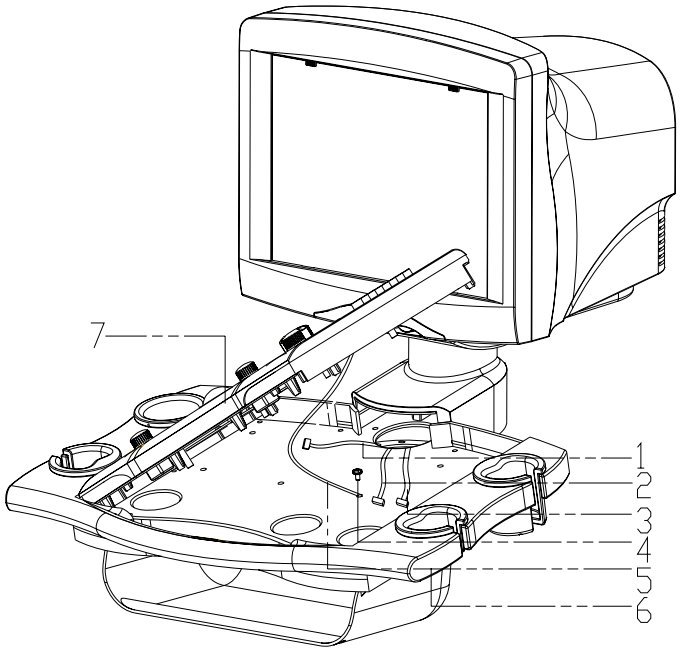
2. Pull out the upper side of the screen, then raise the screen and take it out.

3.4. Disassembly of Keyboard

3.4.1. Disassembly of Keyboard Cover

1. Remove the ten M3×12 screws on the bottom of the keyboard.。
2. Raise the right side of the keyboard.
3. Remove the M3X6 screw.
4. Disconnect the data line, power cord and footswitch cable. Remove the keyboard.

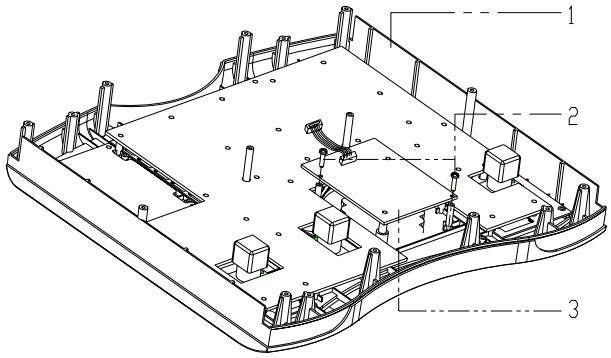




1 – Data Line 2 – Power Cord 3 – Footswitch Cable 4 - M3×6 Screw
5 – Ground Wire 6 - Base 7 - Keyboard

3.4.2. Disassembly of Trackball

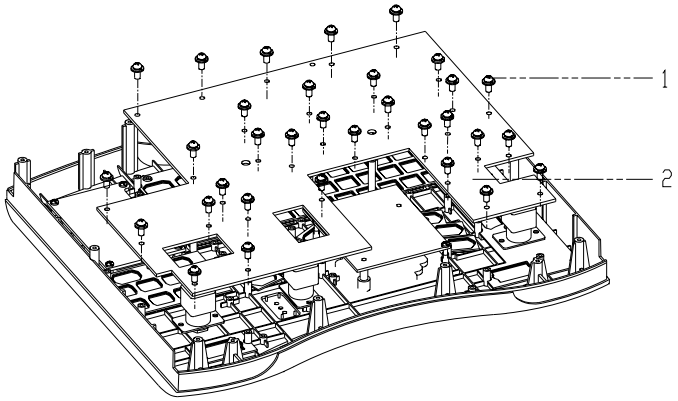
1. Place the keyboard face down and remove the two M2.5×16 screws.
2. Disconnect the trackball cable and raise the trackball.



1 – Keyboard Cover 2 - M2.5×16 Screws 3 - Trackball

3.4.3. Disassembly of Keyboard Board

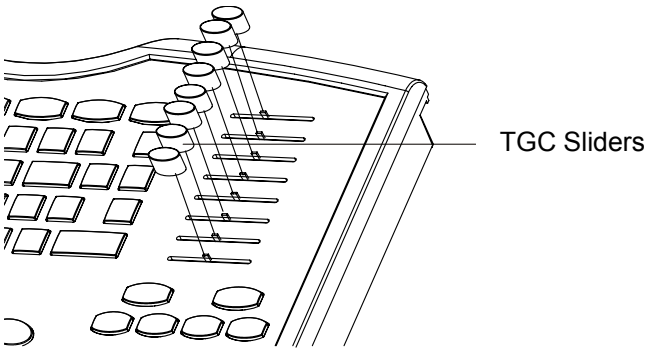
1. Release the 31 M3×6 screws and then remove the keyboard board.



1 - M3×6 Screws 2 – Keyboard Board

3.4.4. Disassembly of TGC Board

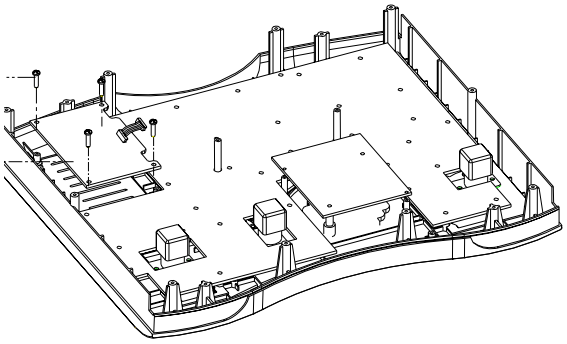
1. Remove the eight TGC sliders.



2. Place the keyboard face down. Disconnect the cable from the TCG board and release the four M3×6 screws.
3. Remove the TGC board.

M3×6 Screws

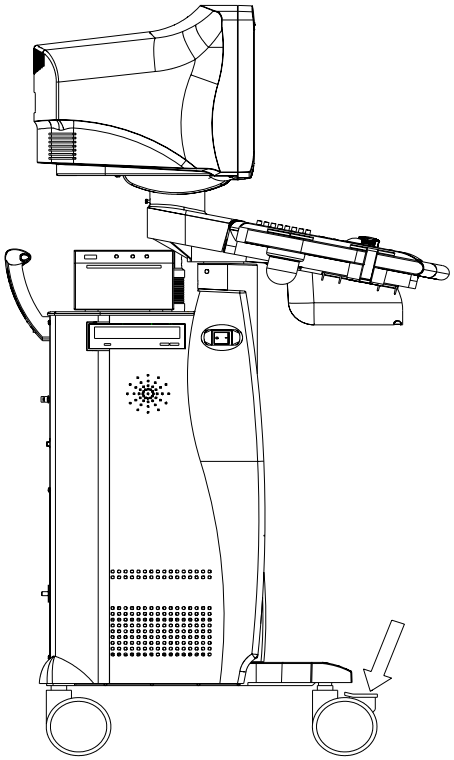
TGC Board



3.5. Disassembly of CD-ROM

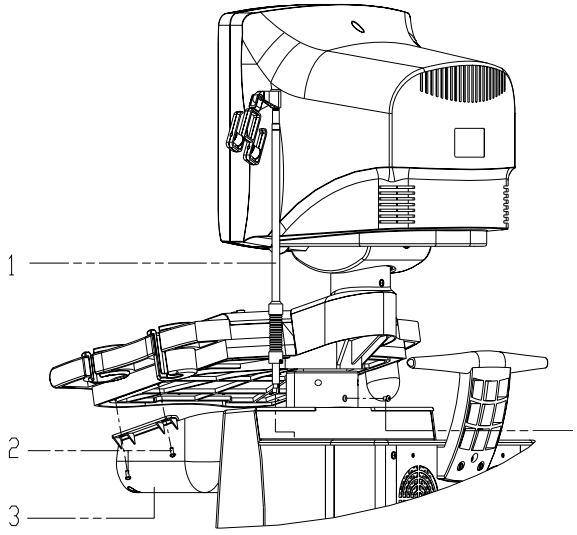
3.5.1. Locking Casters

1. Press the two casters on the front of the system to lock them.



3.5.2. Disassembly of Drawer and Transducer Cable Hanger

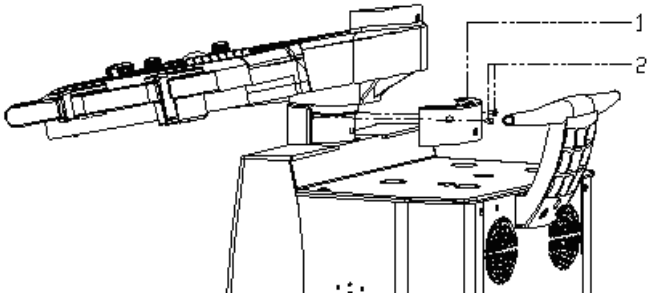
1. Release the four M4×8 screws and remove the drawer.
2. Rotate the transducer cable hanger clockwise until it can be pulled out.



1 – Transducer Cable Hanger 2 – M4×8 Screws 3 - Drawer

3.5.3. Disassembly of Rear Cover of Neck

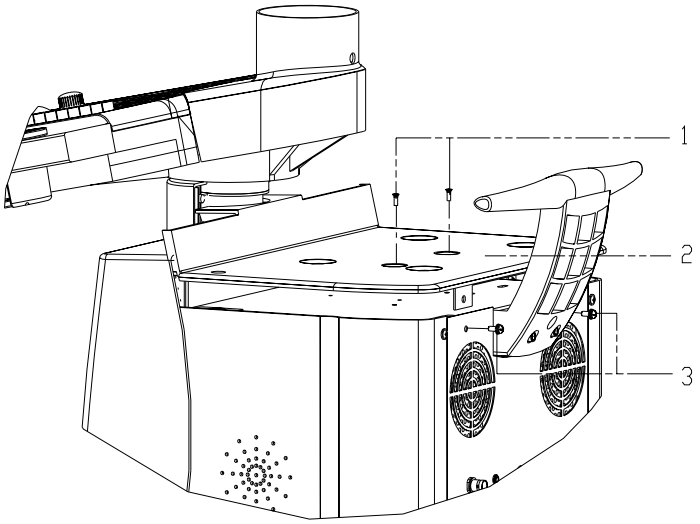
1. Remove the two M3×8 screws and push the rear cover of neck backwards.



1 – Rear Cover of Neck 2 – M3×8 Screws

3.5.4. Disassembly of Top Cover

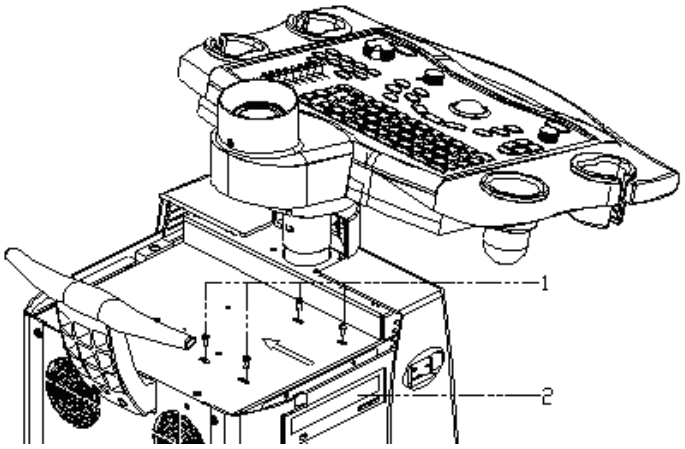
1. Release the two M3×8 screws and the two M4×8 screws. Then raise the top cover.



1 – M3×8 Screws 2 – Top Cover 3 – M4×8 Screws

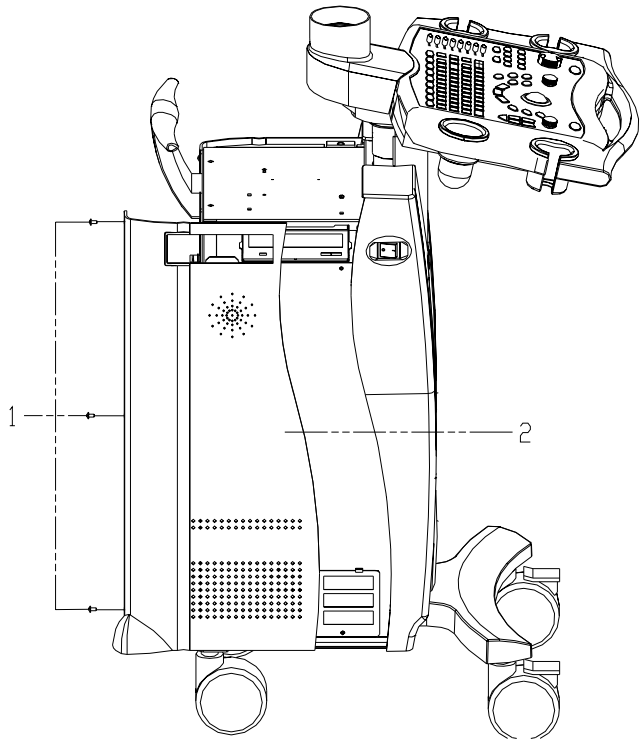
3.5.5. Disassembly of Left Cover

1. Release the four M4×12 screws and push the CD-ROM backwards to its end.



1 – M4×12 Screws 2 – CD-ROM

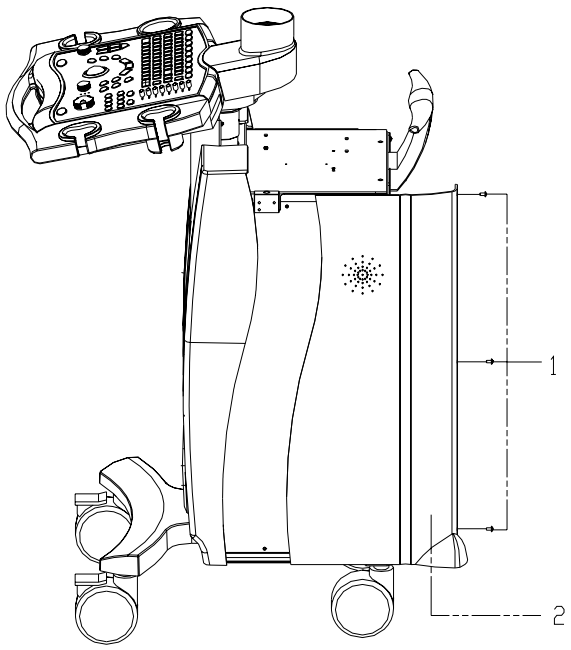
2. Release the three M4×8 screws on the left cover. Push the left cover backwards.



1 – M4×8 Screws 2 – Left Cover

3.5.6. Disassembly of Right Cover

1. Release the three M4×8 screws. Push the right cover backwards.



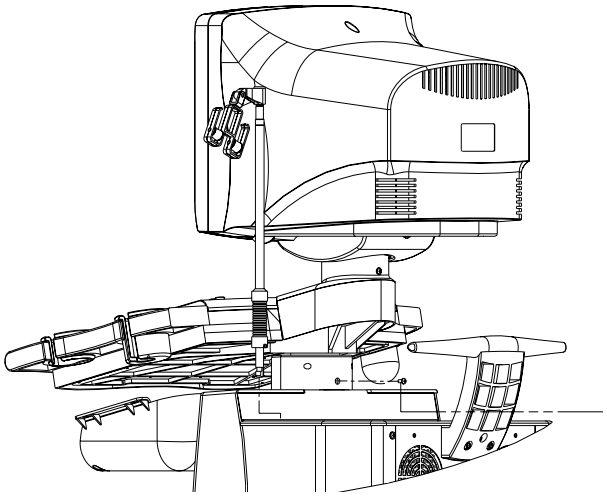
1 – M4×8 Screws 2 – Right Cover

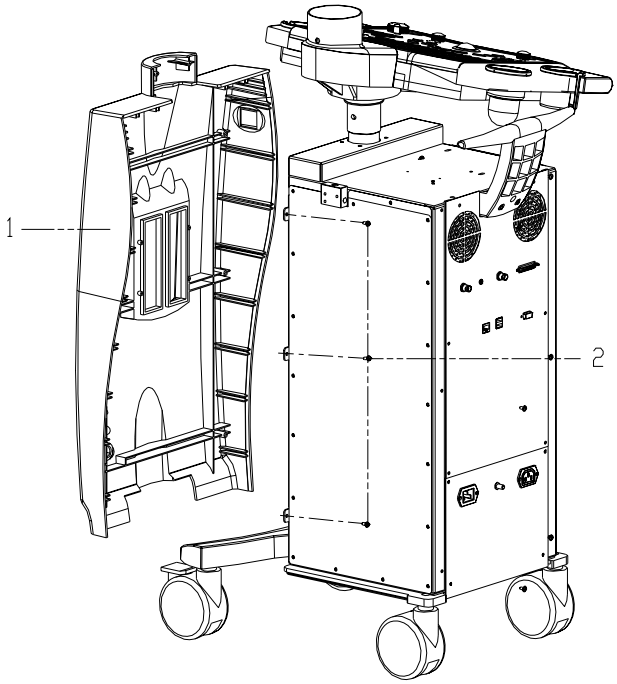
3.5.7. Disassembly of Front Cover

1. Remove the M5×10 screw on the rear of the neck and rotate the keyboard 90°

clockwise (or counterclockwise).

2. Remove the six M4×8 screws.
3. Press the power switch and remove the front cover.

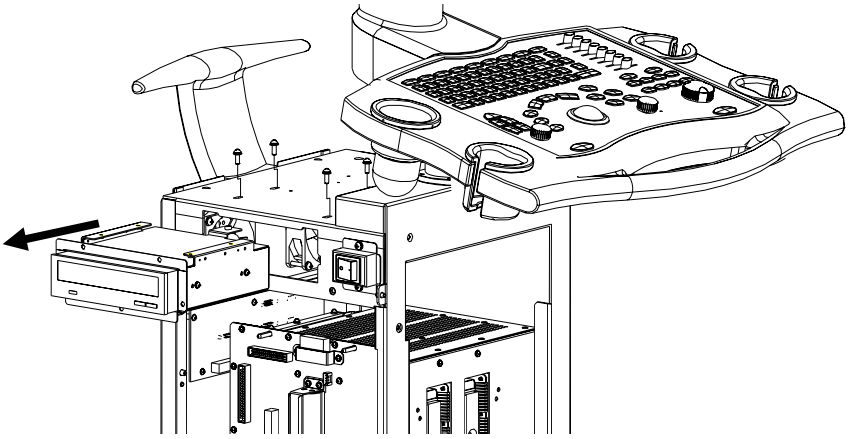




1 – Front Cover 2 – M4×8 Screws

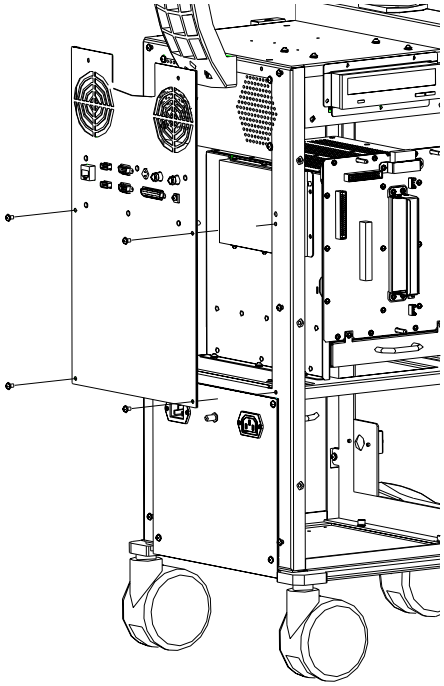
3.5.8.Disassembly of CD-ROM

Disconnect the power cable and data line from the CD-ROM. Release the four M4×12 screws from the top of the framework and remove the CD-ROM.

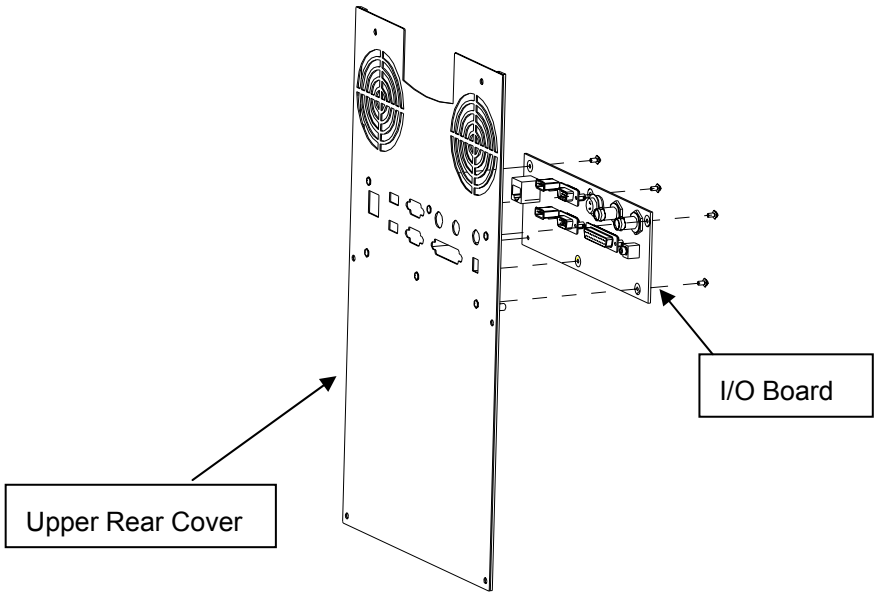


3.6. Disassembly of I/O Board

1. Perform the procedures described from section 3.5.1 to section 3.5.6.
2. Release the six M4×8 screws that secure the upper rear cover. Disconnect cables from the I/O board and then remove the upper rear cover with the I/O board on it.

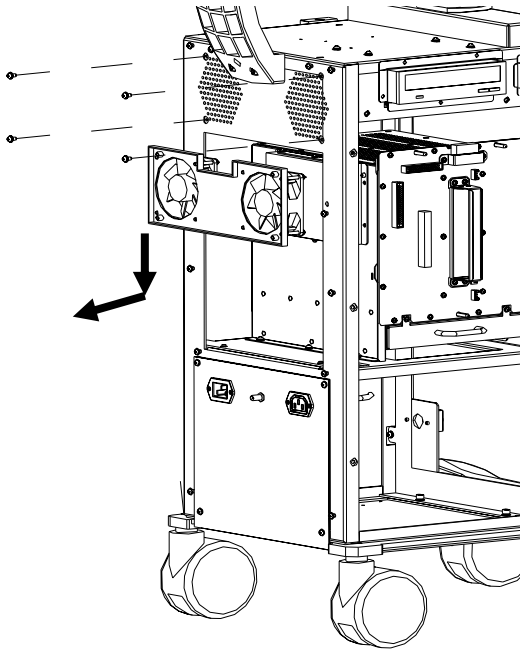


3. Release the six screws that secure the I/O board to the upper rear cover.



3.7. Disassembly of Air Outlet Fan Assembly

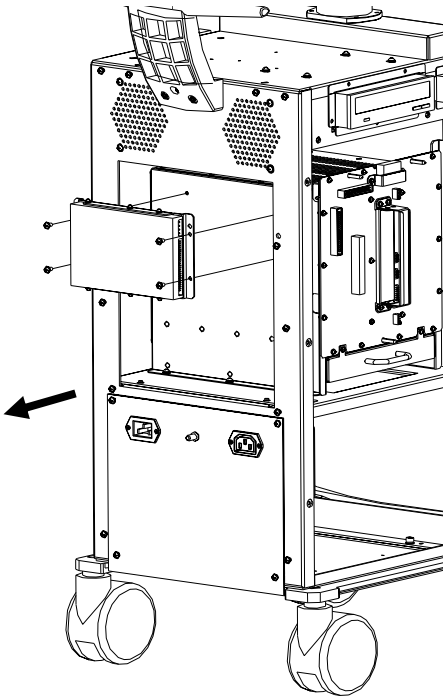
1. Perform the steps 1 and 2 in section 3.6.
2. Disassemble the right cover.
3. Disassemble the upper rear cover.
4. Disconnect cables from the air outlet fan assembly and then remove the four screws that secure the assembly.



3.8. Disassembly of Hard Disk

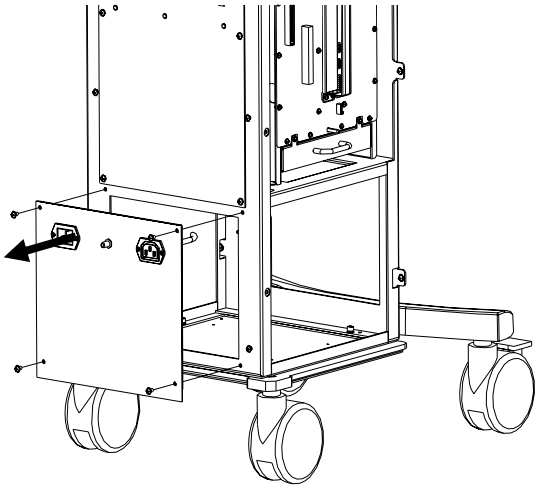
1. Perform the steps 1 and 2 in section 3.6..

2. Disassemble the upper rear cover.
3. Disconnect the power cable and data line from the hard disk and then release the four screws that secure the hard disk.

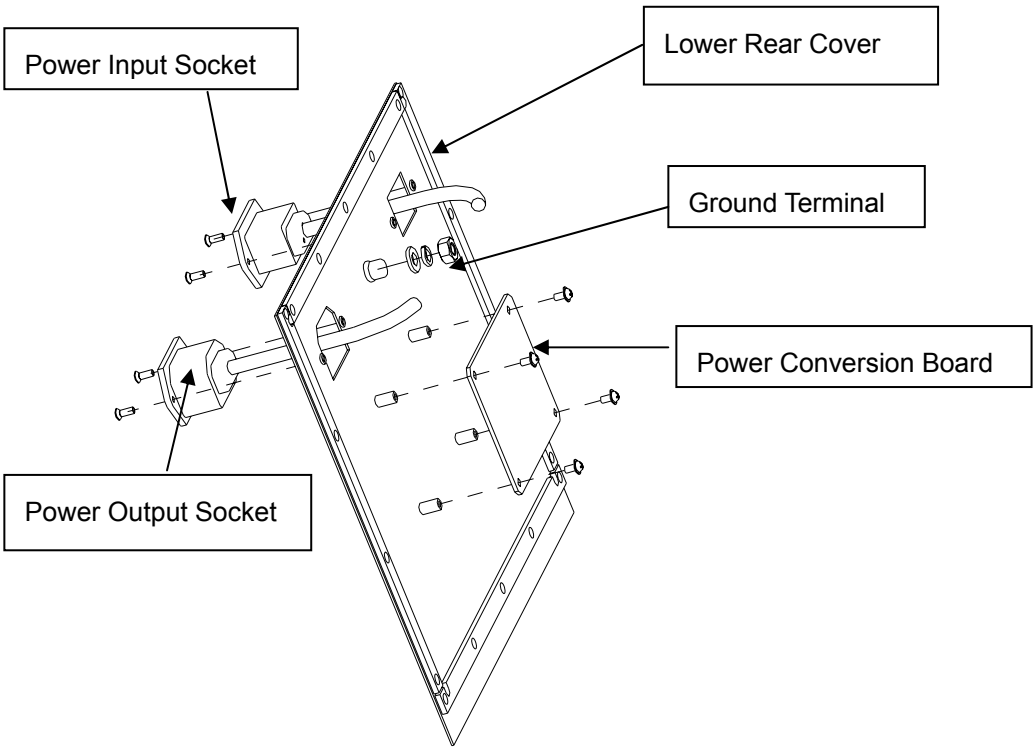


3.9. Disassembly of Power Conversion Board

1. Release the four M4×8 screws on the lower rear cover. Then disconnect cables from the power conversion board and remove the lower rear cover with the power conversion board on it.

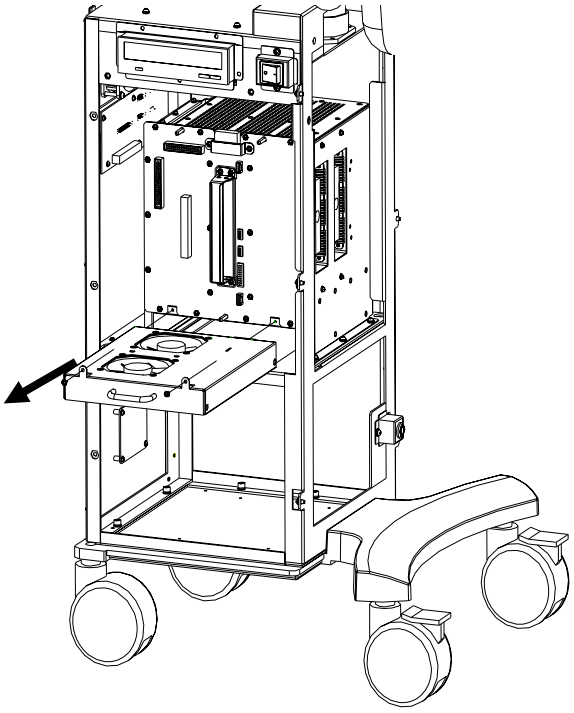


2. Remove the power conversion board from the lower rear cover.



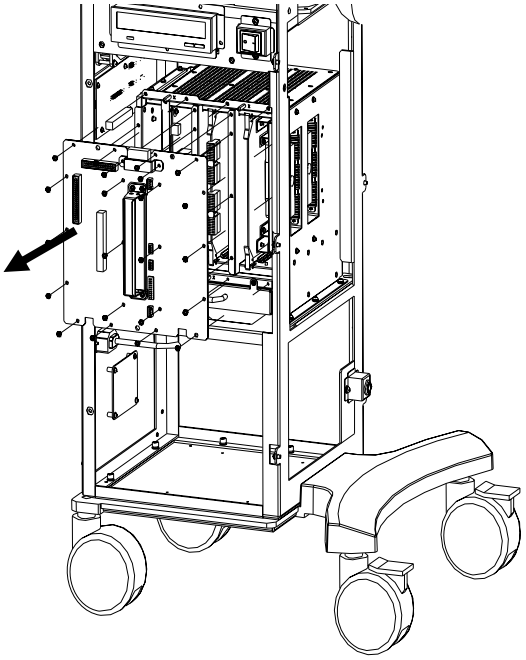
3.10. Disassembly of Air Intake Fan Assembly

1. Perform the procedures described from section 3.5.1 to section 3.5.7.
2. Release the two M4×8 screws that secure the air intake fan assembly and pull out the assembly by its handle.

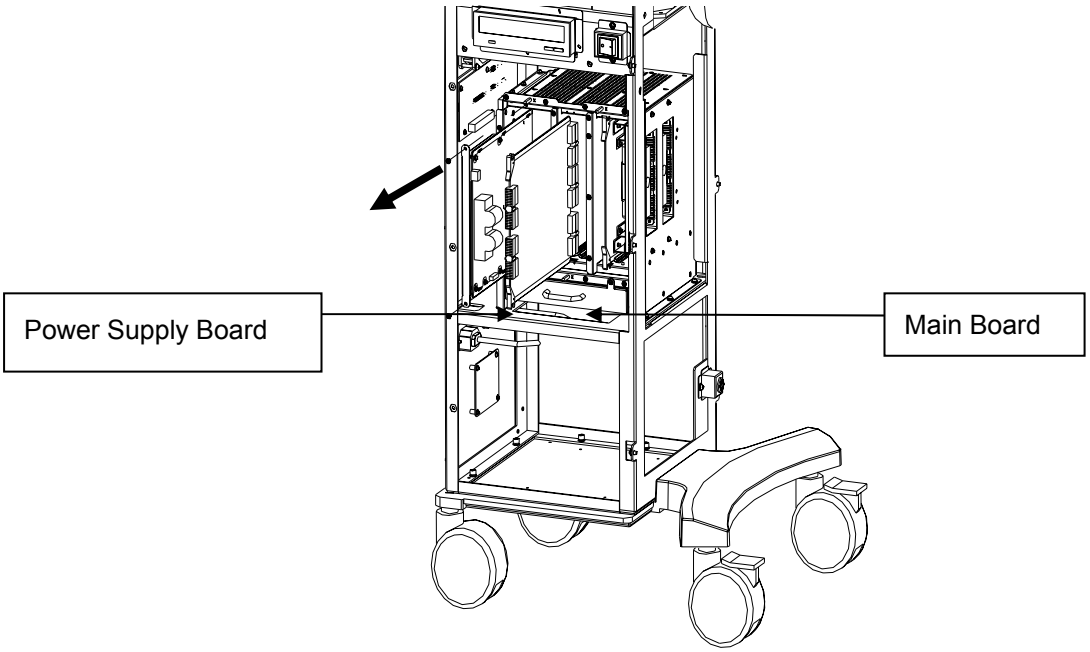


3.11. Disassembly of Output Board, Main Board and Power Supply Board

1. Perform the procedures described from section 3.5.1 to section 3.5.7. Disconnect cables from the output board and remove the screws on the board. Hold the handle on the board and remove it gently.

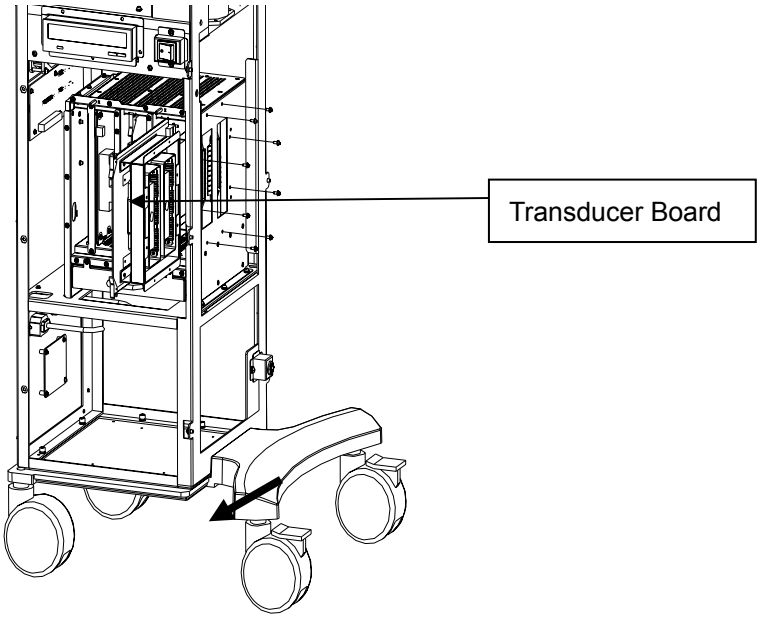


2. Remove the two screws from the power supply board and pull the power supply board by its handle to disassemble it.
3. Hold the two handles on the main board and rotate them outwards to disassemble the main board.



3.12. Disassembly of Transducer Board

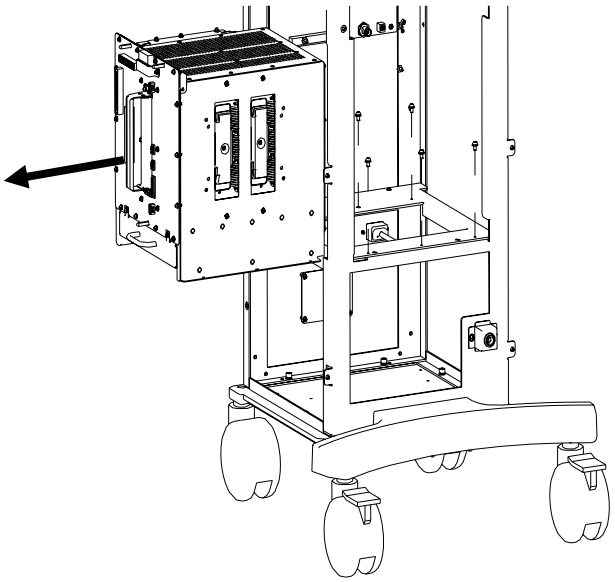
1. Perform the procedures described from section 3.5.1 to section 3.5.7.
2. Disassemble the output board.
3. Remove the eight screws that secure the transducer board shield at the front of the cabinet. Take out the board by its handles.



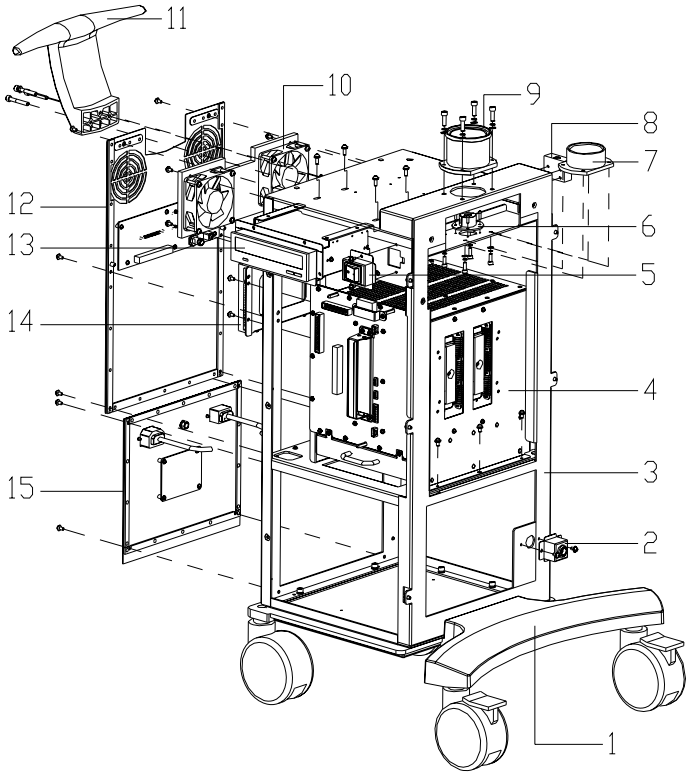
3.13. Disassembly of Cabinet

1. Perform the procedures described from section 3.5.1 to section 3.5.7.
2. Disconnect the cables from the main board and the output board. Remove the six

M4×8 screws and take out the whole cabinet.



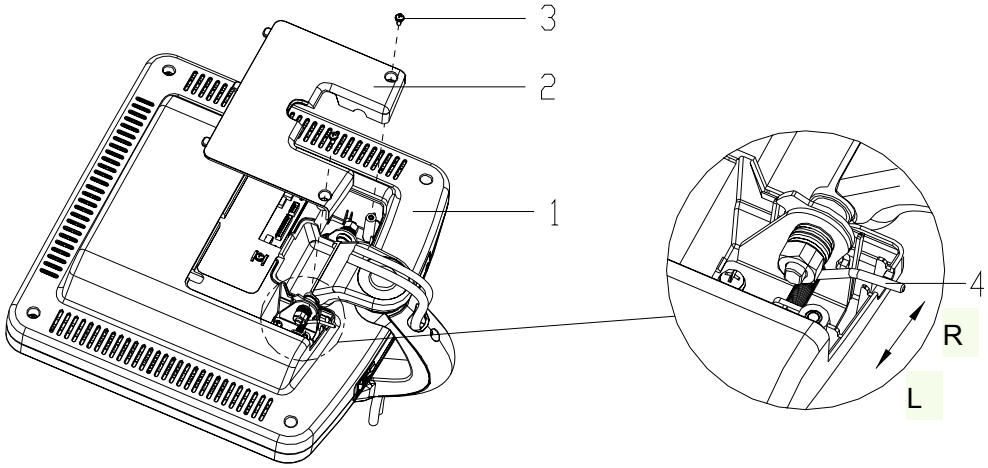
3.14. Diagram



1. Base
2. Footswitch Support
3. Framework
4. Cabinet
5. Power Switch Support
6. Shield Cover
7. Keyboard Pillar Anchor Ear
8. Transducer Cable Hanger Fixed Block
9. Keyboard Pillar Sleeve
10. Air Outlet Fan Assembly
11. Handle
12. Upper Rear Cover
13. CD-ROM
14. Hard Disk
15. Lower Rear Cover

3.15. Disassembly of the LCD Monitor Assembly

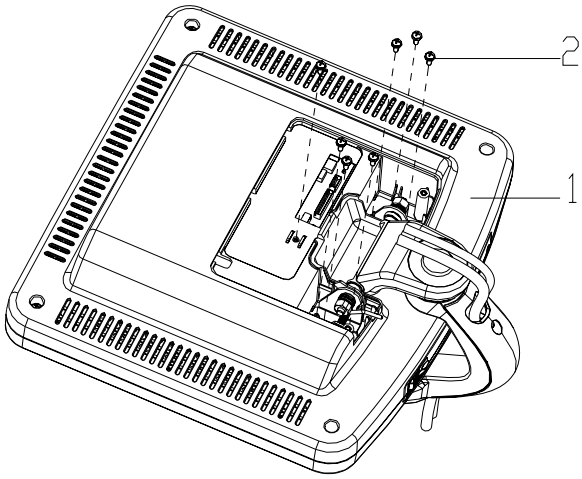
1. Poke the lever left and rotate the monitor to horizontal position. Remove the M4X12 screws (2 pcs) securing the cable cover, and then remove the cover. (The lever locates at left, lower corner of the back of the monitor. When the lever is on the right side, the monitor is in working status and it can be rotated 20 degrees frontward and 20 degrees backward. When packed for transportation or pushed around, poke the lever to the left and you can retract the monitor.)



1. LCD assembly 2. Cable cover 3. M4X12 combination screws (2 pcs) 4. Lever

Disassembly of the LCD Module (1)

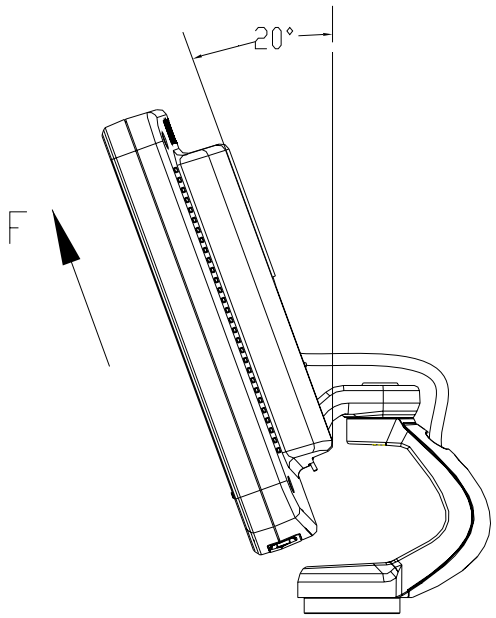
2. Remove the M4X12 combination screw (1 pcs) securing the ground wire clip, take out the cable plug and remove the M4X12 combination screws (6 pcs) securing the monitor.



1. LCD assembly 2. M4X12 combination screws (7 pcs)

Disassembly of the LCD Module (2)

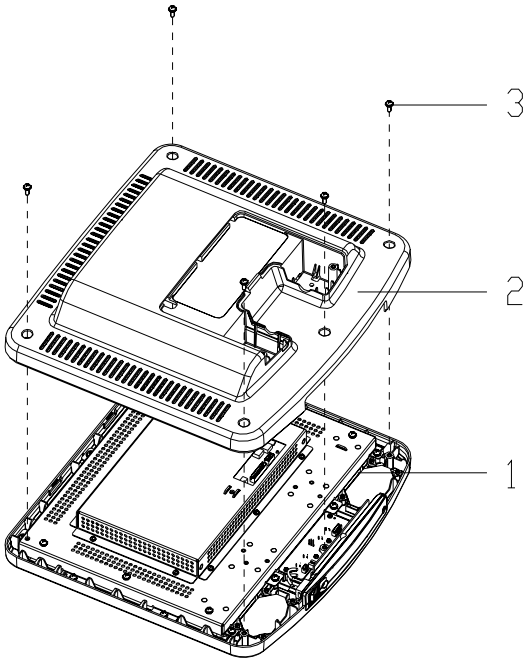
3. Hold the lateral sides of the monitor and raise the monitor to separate it from the support arm hooker when the monitor is 20° from the vertical direction, and then remove the monitor.



Disassembly of the LCD Module (3)

3.16. Replacing the OSD Board of the LCD Monitor

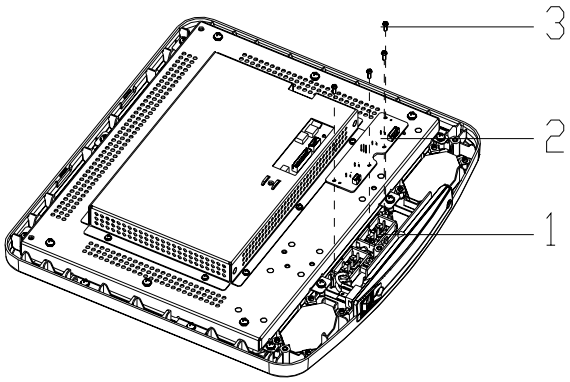
1. Disassemble the monitor module. (Refer to 3.15 Disassembly of the LCD Monitor Assembly)
2. Remove the M4X12 screws (5 pcs) securing the rear cover of the monitor, and then remove the rear cover.



1. Front cover assembly of the LCD 2. Rear cover of the LCD 3. M4X12 combination screws (5 pcs)

Disassembly of the OSD board (1)

3. Pull out the cable plugs from the OSD board, remove the PT3X8 screws (4 pcs) securing the OSD board, and then remove the OSD board.



1. Front cover of the LCD 2. OSD board 3. M3X8 screws (4 pcs)

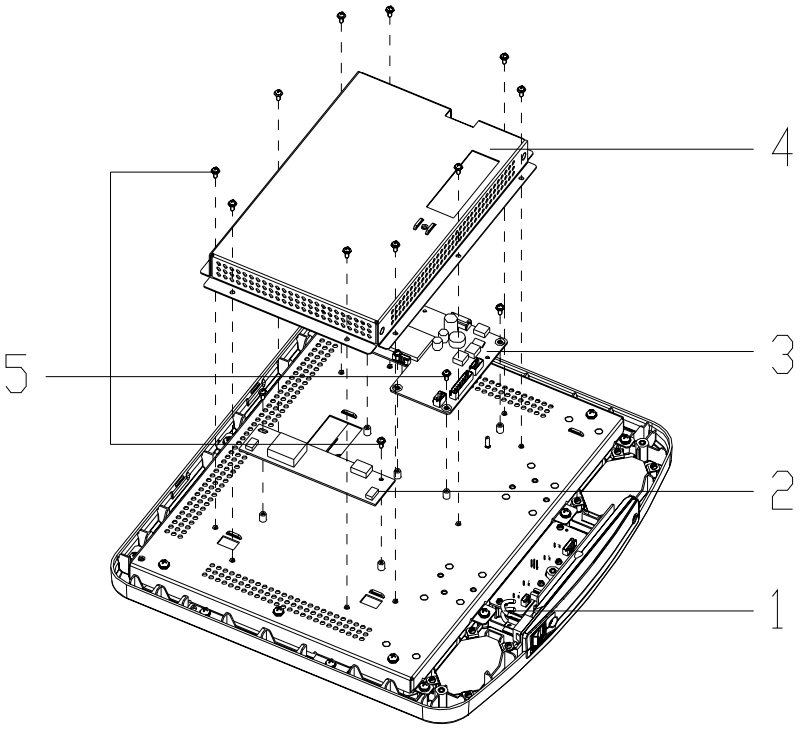
Disassembly of the OSD board (2)

3.17. Replacing the inverter board and control board of the LCD

1. Remove the LCD assembly (refer to 3.15) and the rear cover of the LCD (refer to

step 2 of 3.16).

2. Pull out the plugs from the OSD board of the LCD by the right side of the LCD assembly, remove the M3X8 combination screws (10 pcs) securing the PCB shielding cover, and then remove the PCB shielding cover.
3. Pull out the 2 plugs of the cable connecting the inverter board and the LCD, and then pull out the plug of the cable connecting the inverter board and the control board. Remove the M3X8 combination screws (2 pcs) securing the LCD inverter board, and then remove the inverter board.
4. Pull out the plug of the cable connecting the inverter board and the control board, and then pull out the plug of the cable connecting the control board and the LCD. Remove the M3X8 combination screws (5 pcs) securing the LCD inverter board, and then remove the control board.



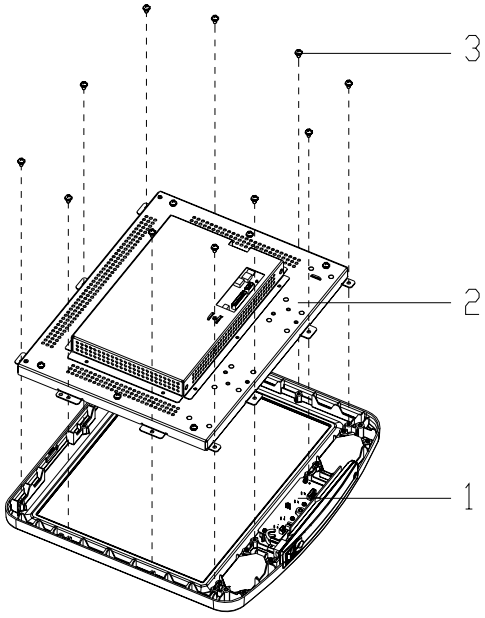
1. Front cover assembly of the LCD 2. Inverter board 3. Control board 4. PCB shielding cover 5. M3X8 combination screws (17 pcs)

Disassembly of the inverter board and the control board

3.18. Replacing the LCD screen of the LCD Monitor

1. Remove the LCD assembly (refer to 3.15) and the rear cover of the LCD (refer to step 2 of 3.16). Pull out the plugs from the OSD board.
2. Remove the M3X8 combination screws (11 pcs) securing the LCD assembly, and

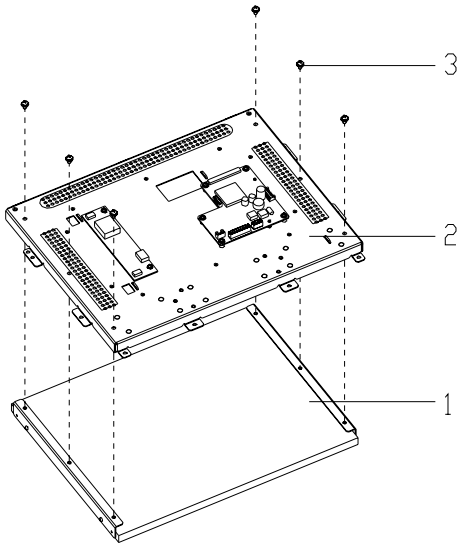
then remove the LCD assembly.



1. Front cover assembly of the LCD 2. LCD assembly 3. M3X8 combination screws (11 pcs)

Disassembly of the LCD screen (1)

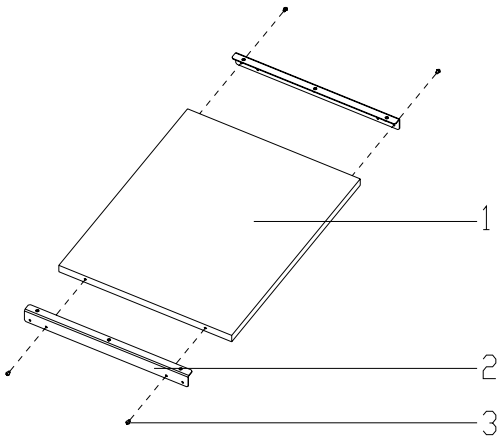
3. Remove the M3X8 combination screws (10 pcs) securing the PCB shielding cover, and then remove the cover. (refer to step 2 of 2.6)
4. Pull out the plugs of the cables connecting the inverter board and the LCD, and then pull out the plug of the cable connecting the control board and the LCD. Cut off the thread fastening the cables (3). Remove the M4X8 combination screws (6 pcs) securing the LCD bracket and the LCD fixing bracket, and then remove the LCD fixing bracket.



1. LCD screen 2. LCD fixing bracket 3. M4X8 combination screws (6 pcs)

Disassembly of the LCD screen (2)

5. Remove the M3X4 panhead screws (4 pcs) securing the LCD screen and the LCD bracket, and then remove and replace the LCD screen.

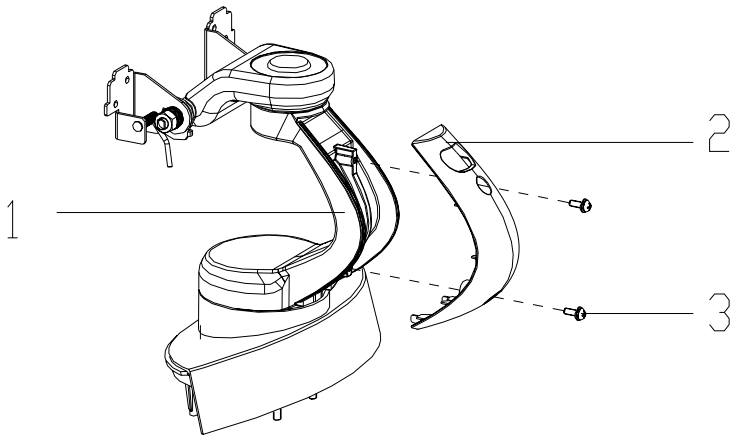


1. Screen 2. LCD bracket 3. M3X4 screws (4 pcs)

Disassembly of the LCD screen (3)

3.19. Disassembly of the LCD support arm assembly

1. Remove the LCD assembly. (refer to 3.15)
2. Remove the M4X12 combination screws (2 pcs) securing the rear cover of the support arm, and then remove the rear cover.

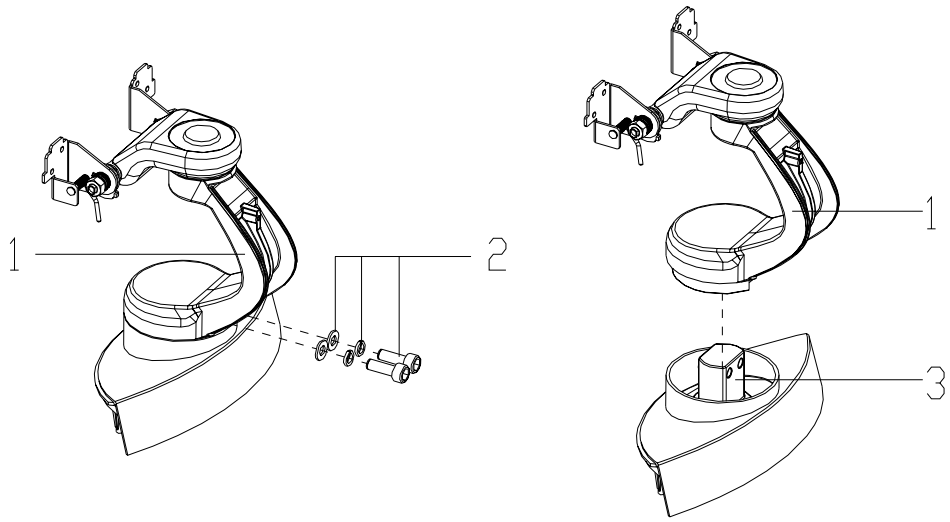


1. Support arm assembly 2. Rear cover of the support arm 3. M4X12 combination screws (2 pcs)

Disassembly of the LCD support arm assembly (1)

3. Remove the M8X25 inner hex screws (2 pcs) securing the support arm and remove

the support arm upward.

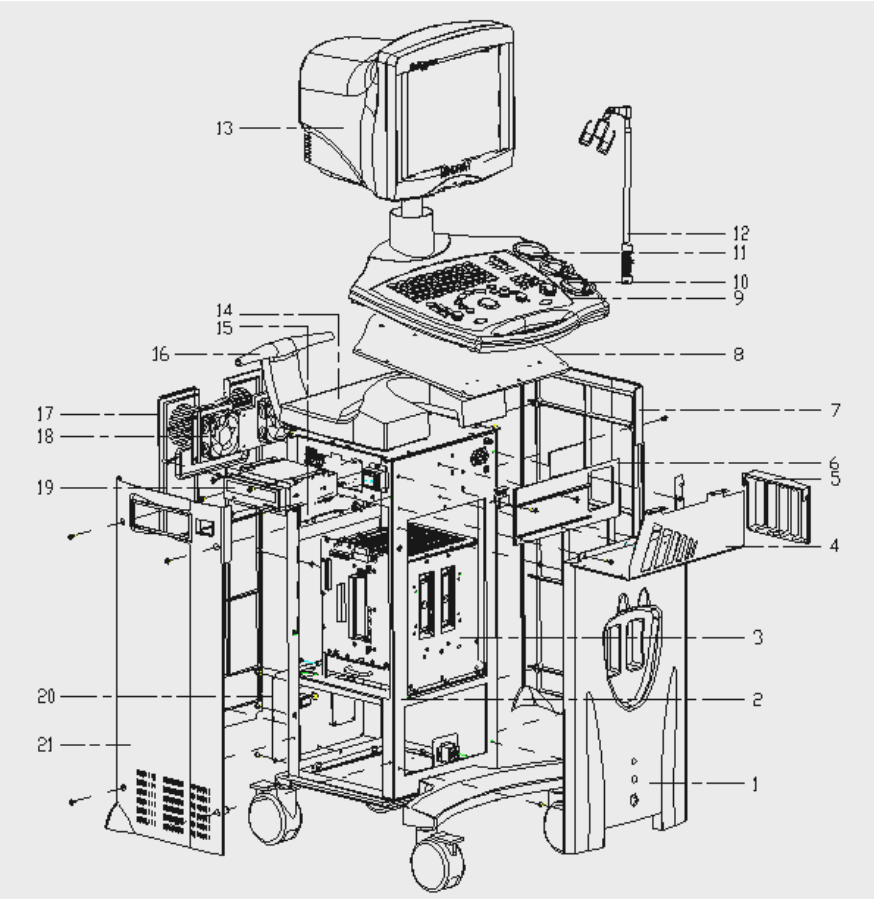


1. Support arm assembly 2. M8X25 inner hex screws with washers 3. Fixing base for rotation (DP-7700)

Disassembly of the LCD support arm assembly (2)

Chapter 4 Disassembly of DP-8800Plus

4.1. System Structure

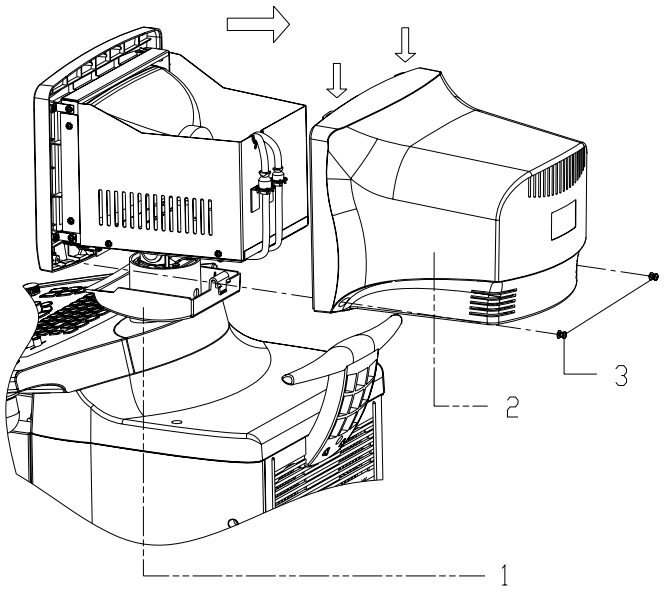


No.	Part No.	Name	No.	Part No.	Name
1	2102-20-16970-51	Front Cover	11	2102-21-17028	Couplant Holder
2	2131-20-71760	Framework	12	2102-30-16949	Transducer Cable Hanger
3	2131-30-71766	Cabinet	13	2106-30-37176	Monitor
4	2102-20-16980	Printer Support	14	2102-20-16966	Top Cover
5	2102-20-16982	Printer Rear Cover	15	2131-30-71778	I/O Board
6	2102-20-16967	Baffle Plate	16	2102-20-17125	Handle
7	2102-20-16978	Right Cover	17	2102-20-16971	Rear Cover
8	2131-30-71750	Keyboard Support	18	9906-30-71443	Air Outlet Fan Assembly
9	2131-30-71827	Keyboard	19	2131-30-71794	CD-ROM

No.	Part No.	Name	No.	Part No.	Name
10	2102-21-17024	Transducer Holder C	20	2131-30-71777	Power Socket Plate (for China)
	2102-21-17026	Transducer Holder D		2131-30-71776	Power Socket Plate (Abroad)
			21	2106-20-37162	Left Cover

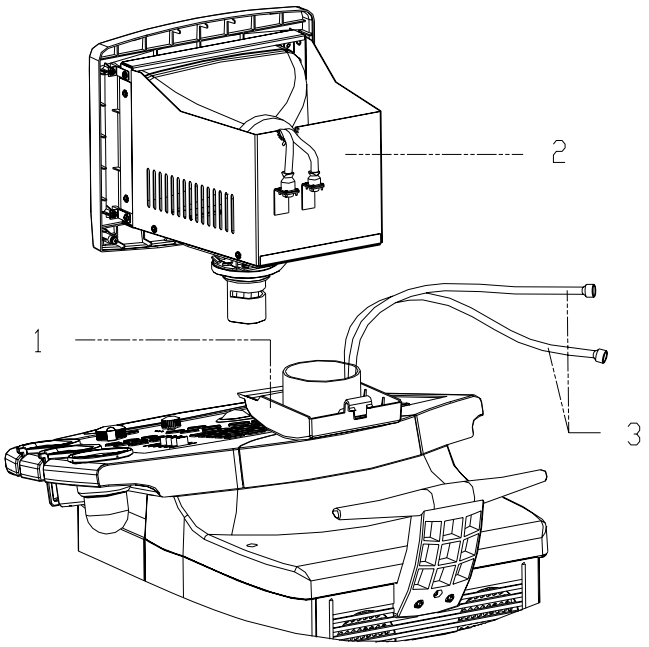
4.2. Disassembly of Monitor

1. Release the neck cover and let it stay around the neck.
2. Remove the two M4×8 screws on the bottom of the monitor.
3. Hold the sides of the monitor with two thumbs pressing the two clips and pull it backwards.



1 – Neck Cover 2 - Monitor 3 – Power Cord and Data Line

4. Disconnect the power cord and data line.
5. Remove the screw on the rear of the neck. Raise the monitor to an appropriate height and pull out the cables from the neck.

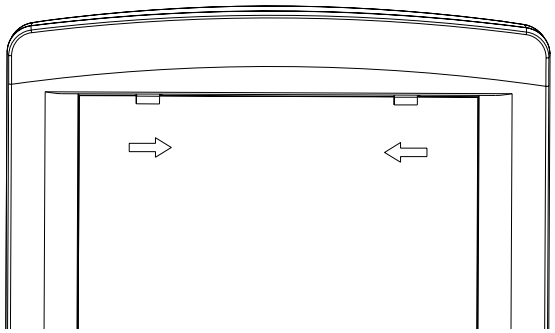


1 – Neck Cover 2 - Monitor 3 – Power Cord and Data Line

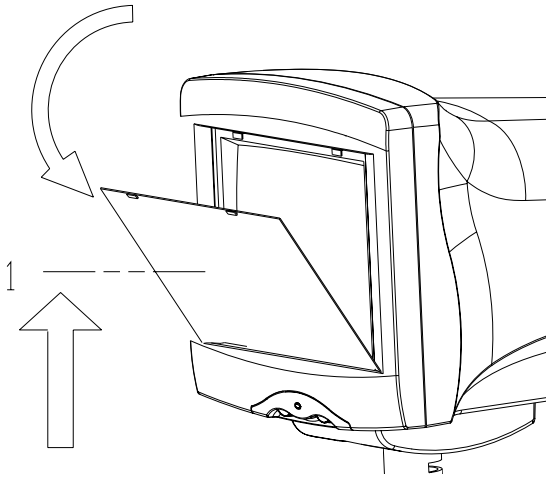
4.3. Disassembly of Screen

1. Push the two clips towards the middle of the screen.

⚠**CAUTION:** Use a finger other than a nail to move the pin. If you move the pin with a nail, the pin may be damaged.



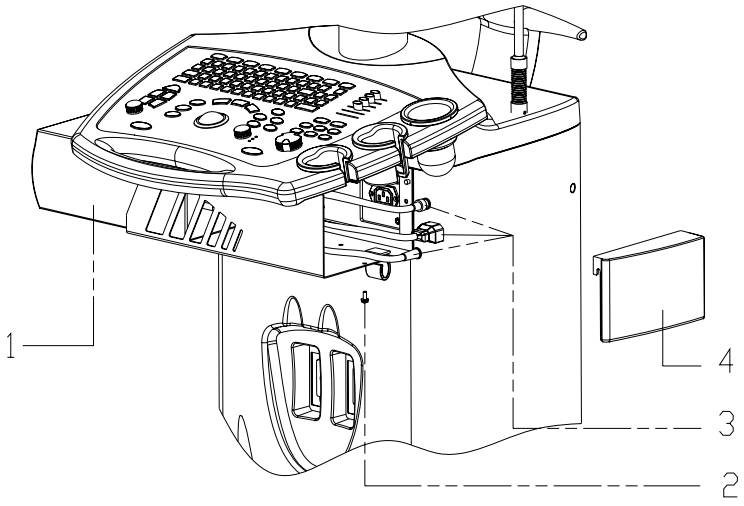
2. Pull out the upper side of the screen, then raise the screen and take it out.



1 - Screen

4.4. Disassembly of Printer

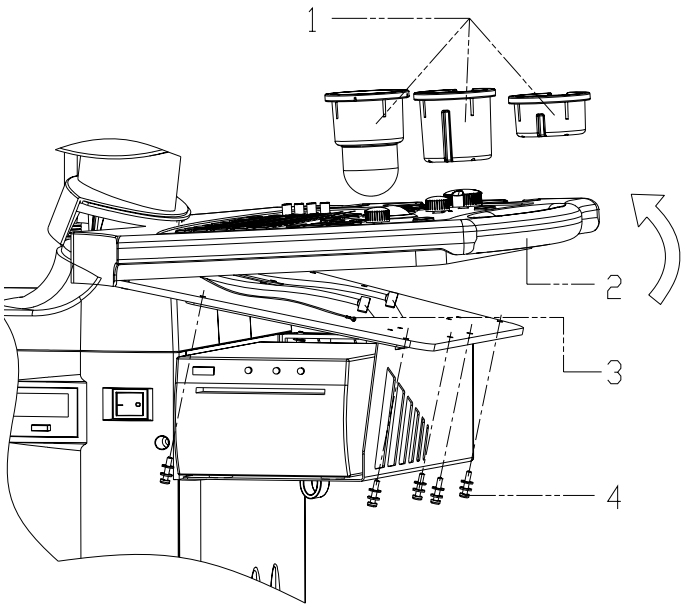
1. Remove the screw on the bottom of the printer support. Push upwards and remove the printer rear cover.
2. Disconnect cables and take out the video printer from the printer support.



1 - Printer 2 - Screw 3 - Cables 4 - Printer Rear Cover

4.5. Disassembly of Keyboard

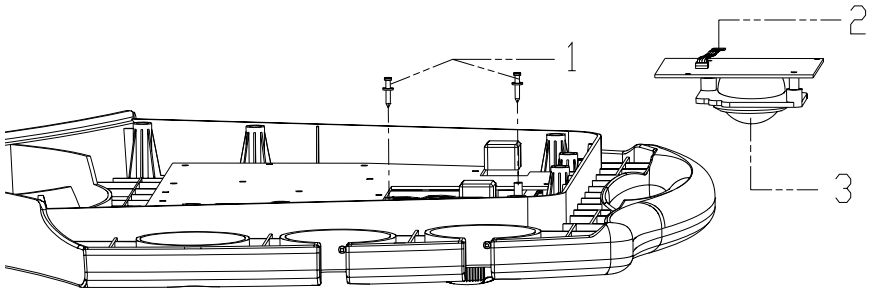
1. Remove the transducer holders.
2. Remove the printer rear cover.
3. Remove the eight M4×8 screws, spring washers and plain washers.
4. Raise the right side of the keyboard and disconnect cables. Raise one side of the keyboard and pull it out.



1 - Transducer Holder 2 - Keyboard 3 - Cables 4 - M4×8 Screws

4.6. Disassembly of Trackball

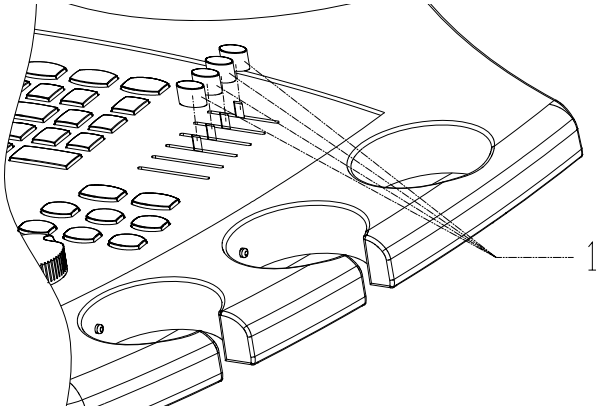
1. Remove the keyboard.
2. Disconnect the cable of the trackball.
3. Remove the two M3×10 screws and take out the trackball.



1 - M3×10 Screws 2 - Cables 3 - Trackball

4.7. Disassembly of TGC Board

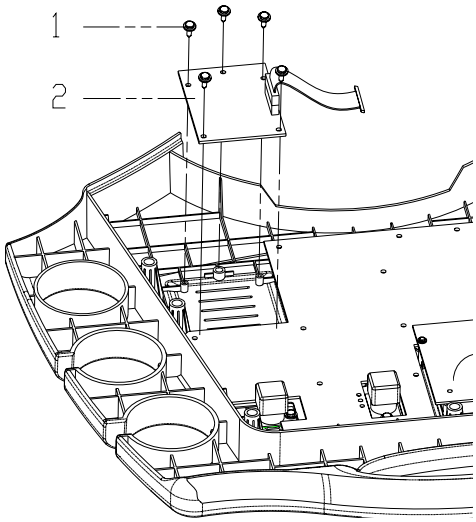
1. Remove the six TGC sliders.



1 – TGC Sliders

2. Disassemble the keyboard.

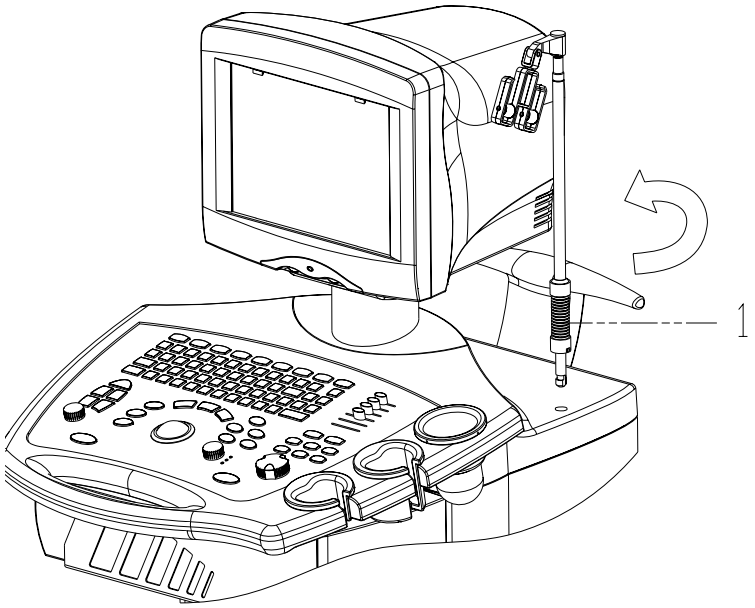
3. Place the keyboard face down. Disconnect cables and remove the three screws from the TGC board.



1 – M3×10 Screws 2 – TGC Board

4.8. Disassembly of Transducer Cable Hanger

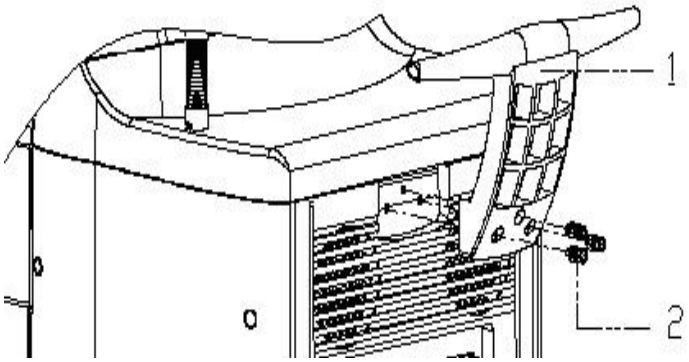
Hold the rubber part of the transducer cable hanger and rotate it clockwise until it can be pulled out. Pull it out.



1 – Transducer Cable Hanger

4.9. Disassembly of Handle

1. Remove the three M5×35 screws and washers.
2. Take off the handle.



1 - Handle 2 – M5×35 Screws

Chapter 5 Maintenance Requirements

5.1. Tools and Consumables

Tools for Maintenance and Clearing

Tool	Model	Manufacturer	Specification
Vacuum Cleaner			Not Specified
Screwdrivers			Not Specified
Blunt Phillips Screwdriver (Queen-size)			Not Specified
Metal Wire Pliers			Not Specified
Nipper Pliers			Not Specified
Diagonal Cutting Pliers			Not Specified
Electric Iron and Holder			Not Specified
Desoldering Gun			Not Specified
Wrench Kit			Not Specified
Adjustable Wrench			Not Specified
Tweezers			Not Specified
Hammer			Not Specified
Metric General Utility Wrench Kit			Not Specified
Cables			Not Specified
Knife			Not Specified
Antistatic Brush			Not Specified

Consumables

Consumable	Model	Manufacturer	Specification
Insulating Tape			Not Specified
Hishilite Tube (Heat-shrinkable Tube) Insulated Conduits			Not Specified
Cables			Not Specified
Screws, Nuts, Washers			Not Specified
Solder Stick			Not Specified
Soft Cleaning Cloth			Not Specified
Glass Cleaner			Not Specified
Neutral Detergent			Not Specified
Ethyl Alcohol (75%)			Not Specified

⚠Warning: 1. Never use deliquescent solvent such as paint thinner or gasoline or abrasive cleanser to clean the system to avoid system damage.

2. Never use hydrocarbon glass cleanser or detergents cleaning OA equipments to clean the monitor to avoid monitor performance degradation.

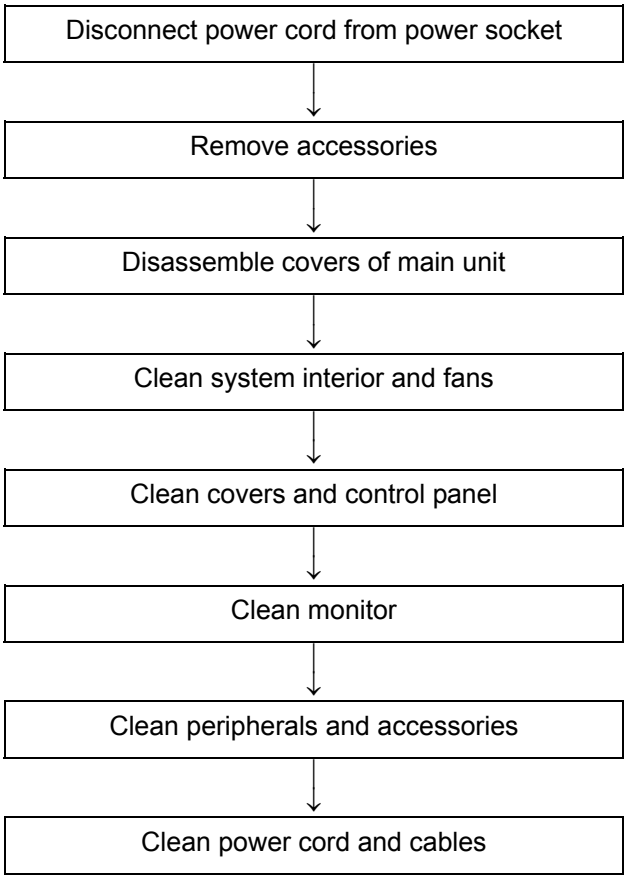
5.2. Maintenance Personnel

To ensure performance and safety of the system, only professional engineers from Mindray or trained to be competent for the system maintenance can maintain the system.

Chapter 6 System Maintenance

6.1. Cleaning

6.1.1. Procedure


Disconnect power cord from power socket
Remove accessories
Disassemble covers of main unit
Clean system interior and fans
Clean covers and control panel
Clean monitor
Clean peripherals and accessories
Clean power cord and cables

6.1.2. Details

1. To clean the interior of the system and fans

   Disconnect the power cord from power socket.

   Remove accessories such as the transducer and printer from the system.

   Disassemble the covers of the main unit.

   Disassemble the air inlet fan assembly and the air outlet fan assembly from the system and remove dust on them.

   Disassemble the cabinet from the framework and remove dust in the cabinet with a dust cleaner. Disassemble boards from the cabinet only when they fail to work.

2. To clean covers and the control panel

Use a clean cloth dipped with neutral detergent to remove dust on the covers of the main unit and on the control panel. If there is some difficulty to clean the control panel, disassemble keys from it and then use neutral detergent to clean it.

3. To clean the monitor

   Check if the monitor is skew and the fixing structure is loose. Use a dry clean cloth to remove the dust on the monitor.

4. To clean the transducer

   Use a dry clean cloth to remove dust on the transducer surface and check if there is abnormality such as crack. Then connect it to the system. Use a soft brush to clean the transducer holder.

5. To clean the video printer

   Clean the thermal head according to the operation manual of the printer.

6. To clean cables

   Use a clean cloth dipped with neutral detergent to clean the power cord and other cables.

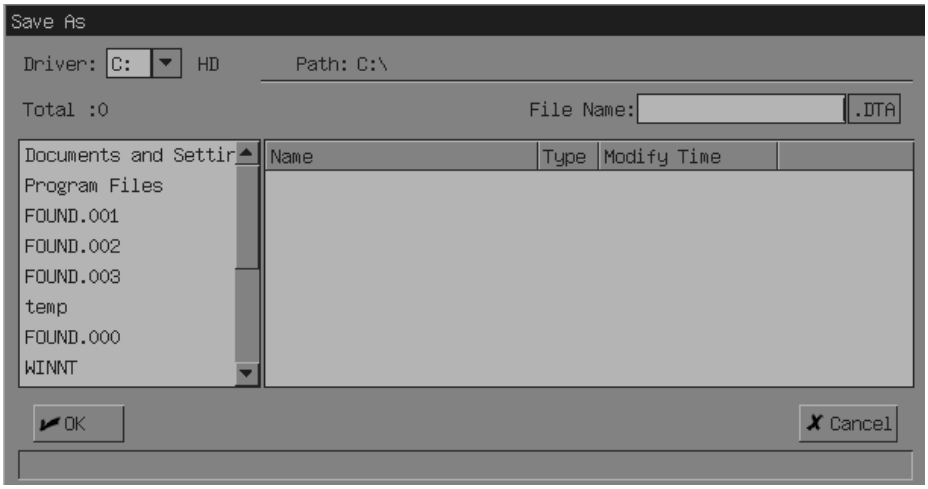
6.2. Software Maintenance

1. Before maintain software, ensure the data to be used matches the system to avoid system damage and backup the preset data according to the following procedure.

   a) Press [Preset] key to enter the preset menu.

   b) Move the cursor to the [Preset Data] and select [Save].

c) Press [Set] key. Then select the driver and the path for the saving and input file name.

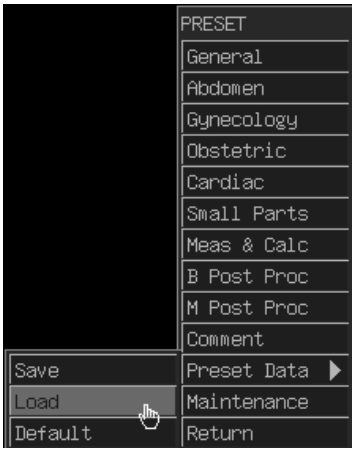


d) Move the cursor to [OK] and press [Set] key.

2. After the software maintenance, recover the preset data according to the following procedure.

a) Press [Preset] key to enter the preset menu.

b) Move the cursor to the [Preset Data] and select [Load].



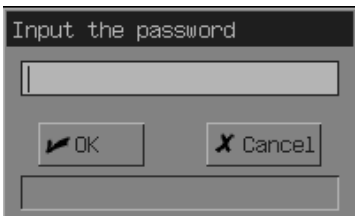
c) Press [Set] key. Then select the driver and the path of the preset data file.

d) Move the cursor to [OK] and press [Set] key.

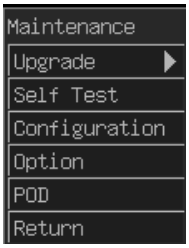
6.2.1. Software Upgrade

1. Press [Preset] key to enter the preset menu.

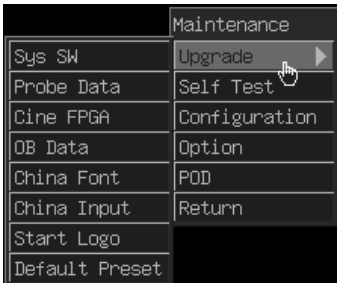
2. Move the cursor to [Maintenance] and press [Set] key to enter the following dialog box. Input password into the dialog box.



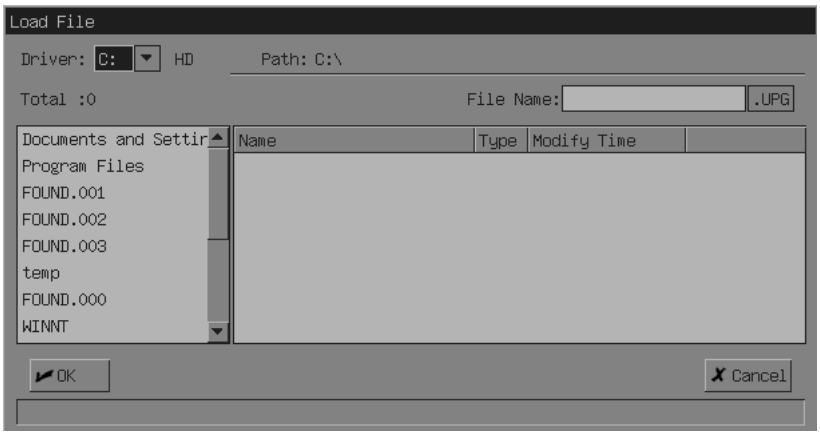
3. Move the cursor to [OK] and press [Set] key to enter the maintenance menu.



4. Move the cursor to the [Upgrade].



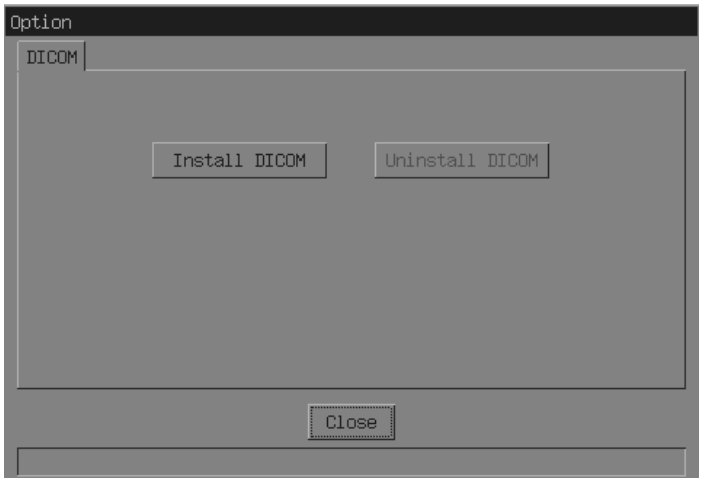
5. Move the cursor to the software or data to be upgraded, for example, [Sys SW], and press [Set] key.



6. Select the UPG file in the directory of corresponding driver and move the cursor to [OK] and press [Set] key to upgrade.
7. After the upgrade is completed, you can upgrade other files according to the procedure described above. After other files are upgraded, restart the system.

6.2.2.Installation/Uninstallation of DICOM

Enter the maintenance menu as the procedure described in 6.2.1. Move the cursor to [Option] and press [Set]. Then input an appropriate password to enter the following dialog box.



1. To install DICOM

   Move the cursor to [Installation DICOM] and press [Set] key. Select the .key file from corresponding directory to complete the installation.

2. To uninstall DICOM

   Move the cursor to [Uninstallation DICOM] and press [Set] key to uninstall DICOM.

6.2.3. System Self-check

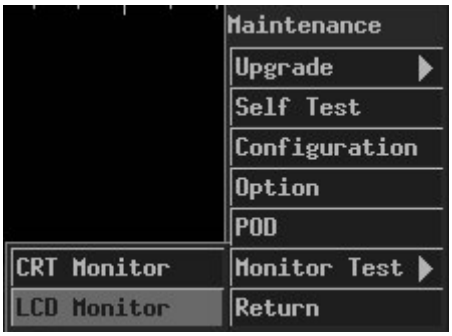
1. Enter the maintenance menu as the procedure described in 6.2.1. Move the cursor to [Self Test] and press [Set] key to enter the system self-check
2. View the self-check report after the self-check is completed.
3. Restart the system.

6.2.4. LCD test

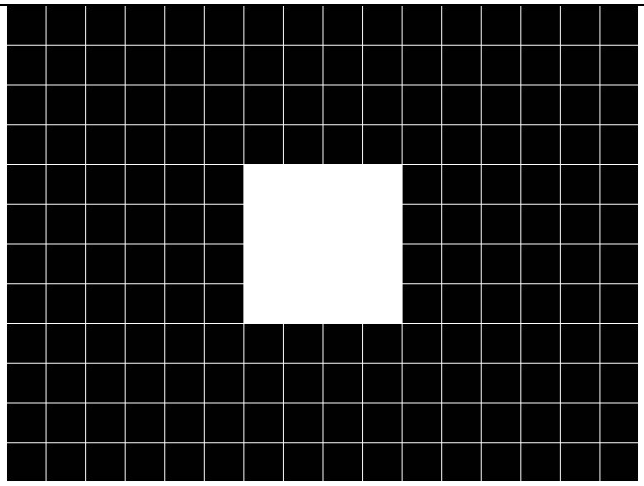
After the LCD monitor is installed onto the main unit, you can check the LCD screen through the LCD test function. The operations are:

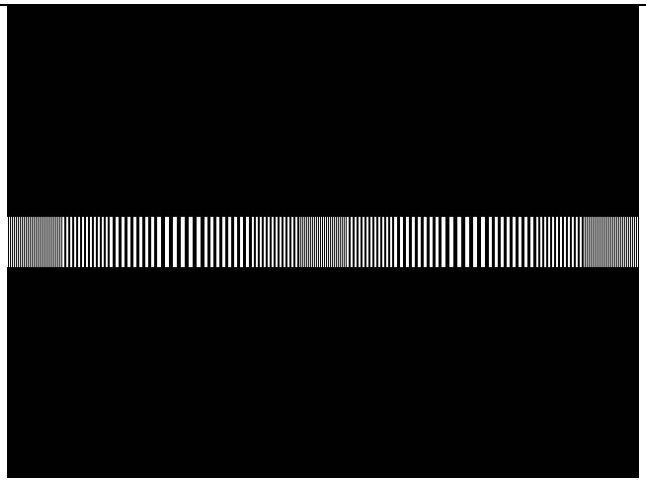
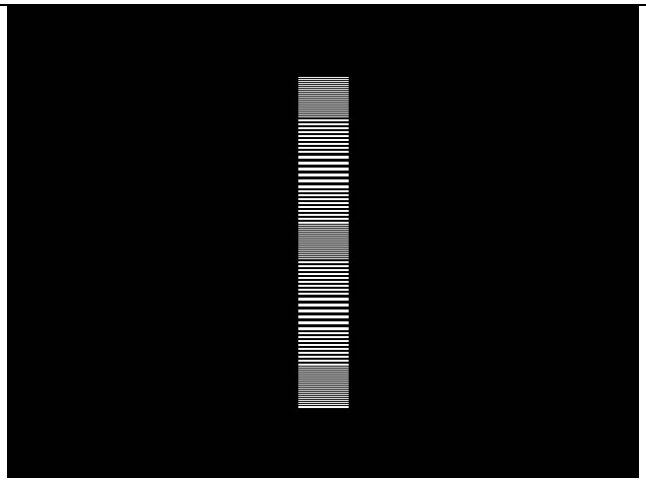
1. Press <Preset> on the control panel to open the preset menu. Click [Maintenance] and input the maintenance password to open the maintenance menu.

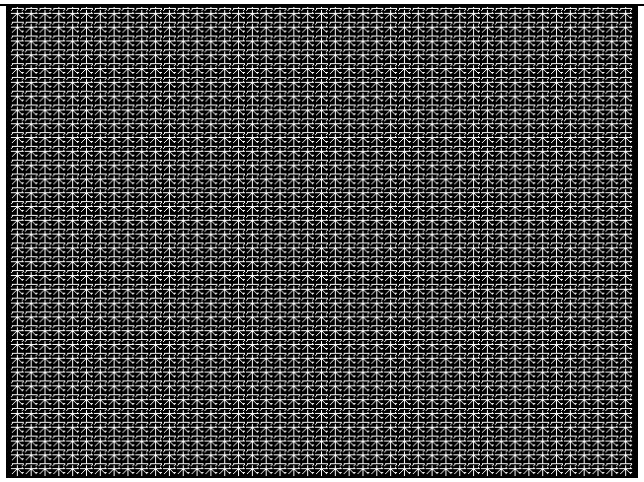
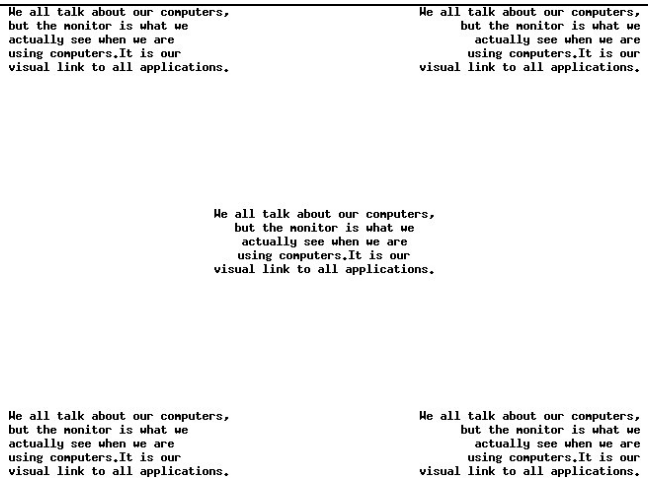
2. Click [Monitor Test] → [LCD Monitor] in the maintenance menu.



3. The pictures displayed and the purposes are:

No.	Pictures	Purpose	Criterion
1		Frame test	The frame is fully displayed

2		Horizontal resolution power test	The vertical stripes should be clear and there is no interference when the resolution is 640*480. (The image is enlarged when the resolution is 800*600, so the strips may be a little fuzzy. It is normal.)
3		Vertical resolution power test	The horizontal stripes should be clear and there is no interference when the resolution is 640*480. (The image is enlarged when the resolution is 800*600, so the strips may be a little fuzzy. It is normal.)
4		Grey scale test	Check whether the grey scale is normal. The grey scale gets brighter from 0 to 255. There is no obvious color cast.

5		Focus test	The characters are clear when the resolution is 640*480 and there is no ghost image or distortion. The image is enlarged when the resolution is 800*600, so the strips may be a little fuzzy. It is normal.
6		Focus test	The characters are clear when the resolution is 640*480 and there is no ghost image or distortion. The image is enlarged when the resolution is 800*600, so the strips may be a little fuzzy. It is normal.
7		Focus test	

8		Bad dot test (black)	There is no bright dot in the whole screen.
9		Bad dot test (white)	The adjoining dark dots are no more than 3 pairs, and there is no adjoining dark dots in image area. There is no adjoining dark dots of 3 or more than 3. The dark dots are no more than 7 and those in the image area are no more than 2 There is no flickering dot. The distance between bad dots is no less than 5mm.

Chapter 7 Troubleshooting

7.1. Power Supply

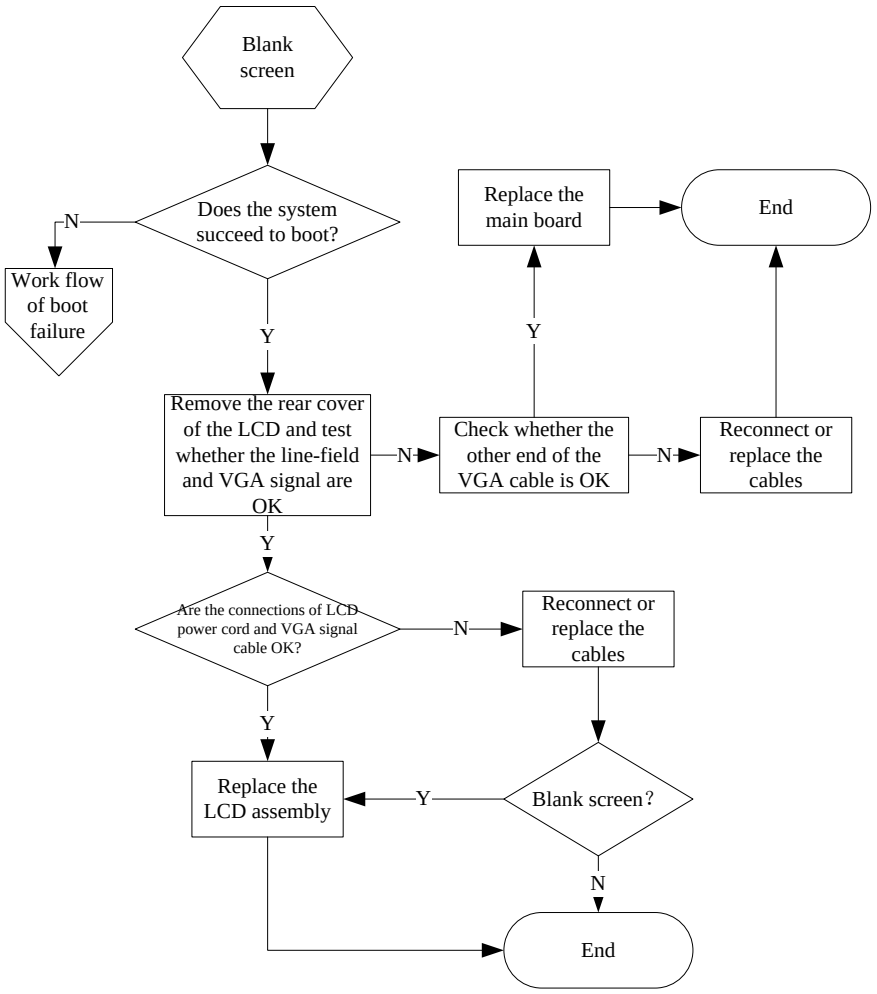
No.	Symptom	Possible Cause	Solution
1	The power indicator does not light up after the power switch is turned on.	The power supply unit of the system does not work properly or the power cord is not connected properly.	Check the power supply unit and the power cord.
2	The power indicator is on but no image appears.	1. The interval between the shutdown and restart is too short. 2. The contrast or brightness of the monitor is abnormal.	1. Restart the system 1 minute after the shutdown. 2. Adjust the monitor with its contrast and brightness buttons.

7.2. Monitor

Note: If nothing is displayed on the monitor, check the contrast and brightness of the monitor and adjust them to medium values. If the monitor is still abnormal, perform according to the following table.

No.	Symptom	Possible Cause	Solution
1	No display and the monitor indicator is off.	The power supply of the monitor fails.	Check the power cord of the monitor.
2	No display and the monitor indicator is on.	1. Monitor signal is wrong. 2. Setting is wrong or the main board fails.	1. Check the data line. 2. Check the connection to the output board. 3. Check the contrast and brightness buttons. 4. Replace the main board.
4	Abnormal image	Monitor signal is wrong.	Check the data line.
5	The screen flickers.	Monitor signal is wrong or the monitor fails.	1. Check the data line. 2. Replace the monitor.

7.3. Troubleshooting of LCD Blank Screen



7.4. Troubleshooting of Other Malfunctions of the LCD

No.	Malfunction	Potential Causes	Measures
1	The image is located in the wrong area, or lateral and vertical strips appear on the image.	The signal is interfered abnormally	Try Auto Adjust under the image without boundary.
2	The image color is abnormal.	The signal is interfered abnormally	Try Auto Color under the black/ white image.
3	There is signal input, but nothing displayed on the screen.	The LVDS cable may be loose	Check the socket of the back-light board, check whether LVDS is connected well with PANEL, and whether LVDS is properly connected with J1 socket of

			AD board.
4	The displaying image is abnormally fluttering.	The LVDS cable is loose or the regulating board is not well fastened	Check whether the regulating board and the sheet metal part is well fastened and the LVDS cable is well connected
5	Appears remnant image.	The monitor may display the same image too long and the screen saver is not turned on	Check whether the display protection program or timer is acting when the same image is displayed for a long time. The remnant image is caused by the LCD itself, please avoid displaying the same image for a long time.
6	The indicator is off and the display of the monitor is normal.	The OSD board is loose or falling off.	Check whether the connection of J5 and button board in the regulating board is OK.
7	The indicator is green and the LCD is blank screen.	The LVDS cable may be loose. The connection cable between regulating board and the inverter may be loose.	Check whether the LVDS cable is well fixed. Check whether the connection between J6 in the regulating board and the inverter is well. Check whether the connection between the inverter CN2 and CN3 is OK.
8	The indicator is orange all the time.	There is no VGA signal input.	If the output of main unit is normal, but the display indicator light is orange and nothing is displayed on the screen, please check whether J7 signal input port is well connected and whether there are voltages input to HSYNC, VSYNC synchronization signals.

7.5. Startup

No.	Symptom	Possible Cause	Solution
1	No startup image is displayed (i.e. the system crashes).	1. The main board is wrong. 2. The output board is wrong.	1. Replace the main board. 2. Replace the output board.

No.	Symptom	Possible Cause	Solution
2	The system crashes after the startup image is displayed.	The main unit fails.	Replace the main board.
3	The system crashes after the menu is displayed.	The main board is wrong.	Replace the main board.
4	The prompt of wrong transducer recognition appears after the menu is displayed.	The transducer or the transducer board is wrong.	1. Replace the transducer. 2. Replace the transducer board.

7.6. Use

No.	Symptom	Possible Cause	Solution
1	Characters are displayed while image is not.	1. Transmission power, gain or TGC control is abnormal. 2. No transducer is connected or the transducer is not connected properly. 3. The system is in the freeze mode.	1. Adjust the admission power, gain or TGC control. 2. Ensure the transducer is connected properly. 3. Unfreeze the image.
2	The quality of image is abnormal.	1. The exam mode is not correct. 2. The setting of image post process is not appropriate.	1. Select an appropriate exam mode. 2. Adjust the post process setting or set it to the default.
3	Slight dark stripe exists in the near field of image.	1. The transducer is wrong. 2. The emission circuit malfunctions.	1. Replace the transducer. 2. Replace the main board.
4	Obvious symmetrical black area exists in the near field of image.	1. The amplifier fails. 2. ADC fails.	Replace the main board.
5	Asymmetrical black area exists in the near field of image.	1. The main board fails 2. The transducer board fails.	1. Replace the main board. 2. Replace the transducer board.
6	Obvious flecks, flickers, bright spots or dark spots exist in the image.	The digital circuit is wrong.	1. Execute the self-check and replace corresponding board as the system instructs. 2. If no prompt appears, replace the main board.

7.7. Software

No.	Symptom	Possible Cause	Solution
1	The hard disk cannot be recognized, i.e., the hard disk indicator is always on or off other than flickers.	1. The CD-ROM is wrong and influences the hard disk. 2. The hard disk is wrong.	1. Disconnect the cable between the CD-ROM and the output board. 2. Replace the hard disk.
2	Insert a U disk or a moveable hard disk into the USB port. But the icon at the lower right side of the screen does not appear and the disk cannot be used.	1. The disk is not supported by the system. 2. The file format of the disk is not FAT or FAT32. 3. If a moveable hard disk is inserted, its power supply may not be sufficient.	1. Use the recommended type of disk. 2. Format the disk into the file format of FAT or FAT32 on the PC. 3. Use an external power supply.
3	The graph/text printer cannot print reports properly.	1. The system does not support the printer. 2. The printer cannot work properly.	1. Use the printer supported by the system. 2. Connect the printer to a PC and confirm if it can work properly in the Windows operation system.

7.8. Others

No.	Symptom	Possible Cause	Solution
1	The fan cannot rotate.	1. The +12V power supply is abnormal. 2. The cable cannot work. 3. The fan is wrong.	1. Check the +12V power supply. 2. Replace the cable. 3. Replace the fan.
2	The Ethernet connection is wrong.	1. The network cable cannot work. 2. The network transformer is abnormal. 3. The main board is wrong.	1. Replace the network cable. 2. Replace the I/O board. 3. Replace the main board.
3	The video signal output is abnormal.	1. The video cable is not connected properly. 2. The I/O board is abnormal. 3. The main board is wrong.	1. Check the cable. 2. Replace the I/O board. 3. Replace the main board.

No.	Symptom	Possible Cause	Solution
4	The control panel has no response when it is operated.	1. The software fails. 2. The power cord of the control panel cannot work. 3. The serial port cable of the control panel cannot work. 4. The control panel is wrong.	1. Restart the system. 2. Replace the power cord of the control panel. 3. Replace the serial port cable of the control panel. 4. Replace the control panel.
5	The trackball has no response when it is turned.	1. The software fails. 2. The connection cable of the trackball cannot work. 3. The trackball is wrong.	1. Restart the system. 2. Replace the connection cable of the trackball. 3. Replace the trackball.

Appendix A Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PRO$_{XL}$ International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe such as Fluke, Metron, or Gerb may require modifications to the procedure. Follow the instructions of the analyzer manufacturer.

The consistent use of a safety analyzer as a routine step in closing a repair or upgrade is emphasized as a mandatory step if an approved agency status is to be maintained. The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

ELECTRICAL SAFETY INSPECTION

1- Power Cord Plug

TEST PROCEDURE

◆ **The Power Plug**	
The Power Plug Pins	No broken or bent pin. No discolored pins.
The Plug Body	No physical damage to the plug body.
The Strain Relief	No physical damage to the strain relief. No plug warmth for device in use.
The Power Plug	No loose connections.
◆ **The Power Cord**	
The Power Cord	No physical damage to the cord. No deterioration to the cord. --For devices with detachable power cords, inspect the connection at the device. --For devices with non-detachable power cords, inspect the strain relief at the device.

ELECTRICAL SAFETY INSPECTION

2- Device Enclosure And Accessories

TEST PROCEDURE

◆ **Visual Inspection**	
The Enclosure and Accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).
◆ **Contextual Inspection**	
The Enclosure and Accessories	No unusual noises (e.g., a rattle inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

ELECTRICAL SAFETY INSPECTION

3- Device Labeling

TEST PROCEDURE

Check the labels provided by the manufacturer or the healthcare facility are present and legible.

- *Main Unit* Label
- *Integrated Warning* Labels
- *Slope and High Voltage Caution* Label
- *Don't Stress* Label

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

VOERVIEW

Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or enclosure. Select the test current by pressing SOFT KEY 3 to toggle between 1AMP, 10AMP, and 25AMP. The front panel outlet power is turned off for this test.

The following conditions apply: L1 and L2 Open.

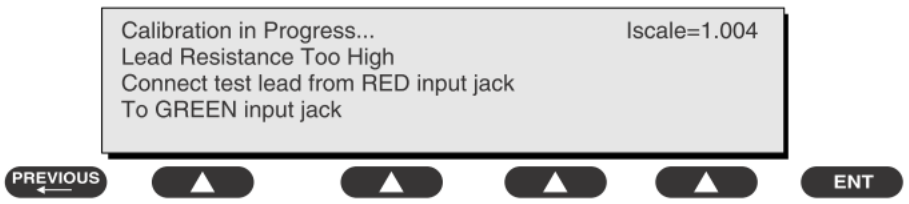
TEST PROCEDURE

◆ Prepare

1) First select the test current that will be used for performing the Protective Earth Resistance test by pressing AMPERES (SOFT KEY 3).

2) Connect the test lead(s) between the RED input jack and the GREEN input jack.

3) Press CAL LEADS. The 601PRO will measure the lead resistance, and if less than 0.150 Ohms, it will store the reading and subtract it from all earth resistance readings taken at the calibrated current.



4) If the calibration fails, the previously stored readings will be used until a passing calibration has occurred.

◆ WARNING

During Earth Resistance testing, the DUT must be plugged into the 601PRO front outlet. If the DUT fails Earth Resistance, discontinue tests and label the device defective.

◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.

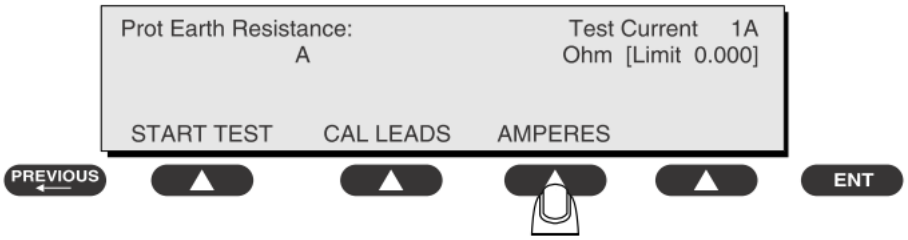
2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed metal area.

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

3) Press shortcut key 3. The Protective Earth Resistance test is displayed.

4) Press SOFT KEY 3 to select a test current (1AMP, 10AMP, or 25AMP). The selected test current is displayed in the upper right corner of the display.



5) Press START TEST to start the test. The test current is applied while resistance and current readings are taken. This takes approximately 5 seconds.

6) Press the print data key at any time to generate a printout of the latest measurement(s).

◆ Note

When "Over" is displayed for Ohms, this signifies that a valid measurement was not obtained because either an open connection was detected or that the measurement was not within range. Readings greater than 9.999 Ohms will be displayed as Over.

◆ Failure

Once it reaches the limitation, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

ALL COUNTRIES R = 0.2Ω Maximum

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

OVERVIEW

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

Leakage current is measured the following ways:

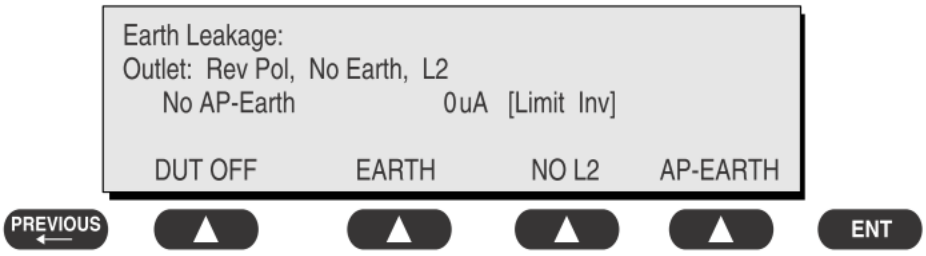
- Earth Leakage Current, leakage current measured through DUT outlet Earth
- Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

There is no need to attach a test lead; the 601PRO automatically connects the measuring device internally.

TEST PROCEDURE

◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the device's applied parts to the 601PRO applied part terminals if applicable.
3) Press shortcut key 4.The Earth Leakage test appears on the display, and the test begins immediately:



- SOFT KEY 1 toggles the DUT outlet Polarity from Normal to Off to Reverse.
- SOFT KEY 2 toggles the DUT outlet from Earth to No Earth.
- SOFT KEY 3 toggles the DUT outlet from L2 to No L2.
- SOFT KEY 4 toggles the AP to Earth to No AP to Earth.

4) Press the print data key at any time to generate a printout of the latest measurement.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

USA:	300 μA Normal Condition
	1000 μA Single Fault Condition
OTHER COUNTRIES::	500 μA Normal Condition
	1000 μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

OVERVIEW

Patient leakage currents are measured between a selected applied part and mains earth. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

◆ Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

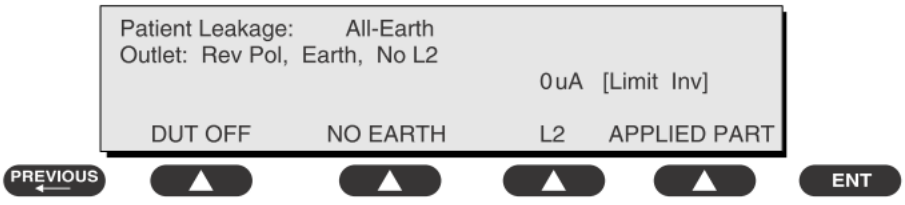
Normal Polarity, Earth Open, Outlet ON	Normal Polarity, Outlet ON
Normal Polarity, L2 Open, Outlet ON	Reversed Polarity, Outlet ON
Reversed Polarity, Earth Open, Outlet ON	Reversed Polarity, L2 Open, Outlet ON

◆ WARNING

If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the applied parts to the 601PRO's applied part terminals.
3) Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



4) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current.

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO.

6) Press the print data key at any time to generate a printout of the latest measurement.

◆ Note

If the current test standard being used does not include Patient Leakage DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections. Refer to Chapter 8, Standards and Principles.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

USA:

For ECG Input and ECG Input and transducer

10 μ A Normal Condition

50 μ A Single Fault Condition

OTHER COUNTRIES:

For ECG Input(Defibrillator proof)

10 μ A Normal Condition

50 μ A Single Fault Condition

For ECG Input and transducer

ELECTRICAL SAFETY INSPECTION
6- Patient Leakage Current
100 µ A Normal Condition 500 µ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) to applied parts in the normal and reverse polarity conditions as indicated on the display.

The following outlet conditions apply when performing the Mains on Applied Part test.

Normal Polarity;

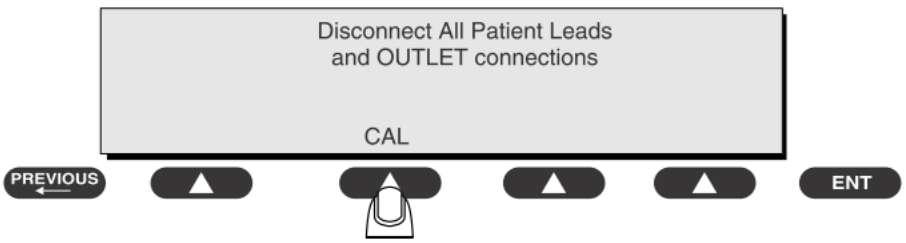
Reversed Polarity

TEST PROCEDURE

◆ Prepare

To perform a calibration from the Mains on Applied Part test, press CAL (SOFT KEY 2).

1) Disconnect ALL patient leads, test leads, and DUT outlet connections.
2) Press CAL to begin calibration, as shown:



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred. Also, the esc/stop key has no effect during calibration.

3) When the calibration is finished, the Mains on Applied Part test will reappear.

◆ WARNING

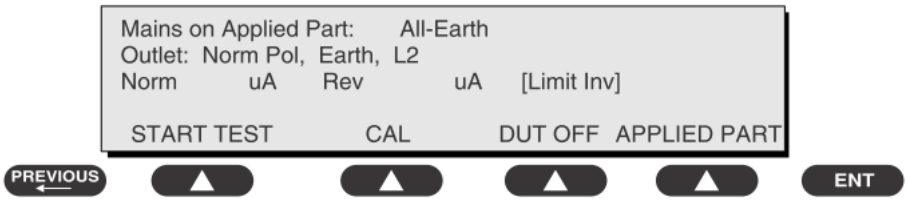
1) A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
2) High voltage is present at applied part terminals while measurements are being taken.

◆ Performance

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601
2) Attach the applied parts to the 601PRO applied part terminals.
3) Attach the red terminal lead to a conductive part on the DUT enclosure.
4) Press shortcut key 7. The Mains on Applied Part test is displayed.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage



5) Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:
6) Press START TEST (SOFT KEY 1) to begin the test.
7) Press the print data key to generate a printout of the latest measurement.

◆ Note

If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

USA：

For ECG Input and ECG Input and transducer

50 μ A

OTHER COUNTRIES：

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

For ECG Input

50 μ A

For ECG Input and transducer

5000 μ A

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

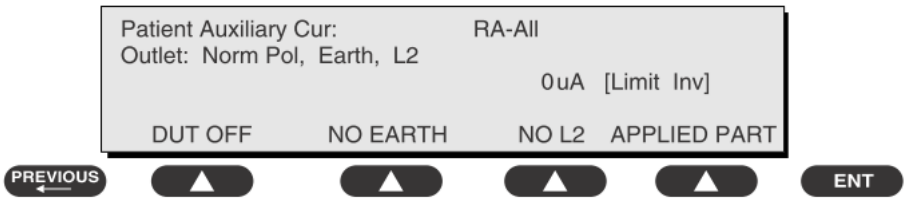
OVERVIEW

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

◆ Prepare

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the patient leads to the 601PRO ECG jacks.
3) Define the Lead Types from the View Settings Option (refer to: Lead Type Definitions in Section 5 of this chapter).
4) Press shortcut key 8. The Patient Auxiliary Current test is displayed, and the test begins immediately. Display values are continuously updated until another test is selected.



5) Press SOFT KEYS 1-4 to select leakage tests
6) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current:
7) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO:
8) Press the print data key at any time to generate a printout of the latest measurement.

◆ Note

If the current test standard being used does not include Patient Auxiliary Current DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

USA：

For ECG Input and ECG Input and transducer

10 μ A Normal Condition

50 μ A Single Fault Condition

OTHER COUNTRIES:

For ECG Input

10 μ A Normal Condition

50 μ A Single Fault Condition

For ECG Input

100 μ A Normal Condition

500 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION

9- Functional test

TEST PROCEDURE	
9.1 Power	➢ Check that the breaker can be normally turned on or off.
9.2 Monitor	➢ Check if the color is pure, the image is clear and intact; the brightness is moderate; there is no defocusing and the image is not dithering.
9.3 The Touch Screen	➢ Check if keys on the touch screen of each exam mode can respond normally.
9.4 Control Panel	➢ Check that the keys can normally work as per the order of left to right and up to down. ➢ Check that the Trackball can normally work.
9.5 Displayed Time and Date	➢ Check that the displayed time and date are correct. If not, correct them.
9.6 General Operations	➢ Check that the Freeze key can freeze or unfreeze an image. ➢ Check that the gain key can normally work. ➢ Check that the B, M, PW, CS, Color, 3D, 4D modes can be normally switched.
9.7 Measurement	➢ Pressing the Freeze key can enter the freeze status, and pressing the Measure key can enter the measurement status. ➢ Measure the vertical distance and horizontal distance to confirm that the trackball can normally work.
9.8 The Peripherals	➢ Check that the CD can normally eject. ➢ Check the USB device can be operated normally. ➢ Press the Freeze key to enter the freeze status, and pressing the Print key to check the Video

ELECTRICAL SAFETY INSPECTION 9- Functional test	
	printer and Text printer can work normally.
9.9 Probe sockets & Probes	➢ Check that the transducer can be normally disconnected, and it can normally work after connected to the socket.
9.10 Casters	➢ Check the casters can be locked and unlocked normally.
9.11 The Fans	➢ Turn on the power of the main unit and check that the fan installed on it is running smoothly. ➢ Check that the fan doesn't give abnormal sound when running.

ELECTRICAL SAFETY INSPECTION FORM

American version

Overall assessment:

□	Scheduled inspection	Test item: 1, 2, 3, 9
□	Unopened repair type	Test item: 1, 2, 3, 9
□	Opened repair type, not modify the power part including transformer or patient circuit board	Test item: 1, 2, 3, 4, 5, 9
□	Opened repair type, modify the power part including transformer or patient circuit board	Test item: 1, 2, 3, 4, 5, 6, 7, 8, 9

Location				Technician	
Equipment				Control Number	
Manufacturer		Model		SN	
Measurement equipment /SN				Date of Calibration	
INSPECTION AND TESTING				Pass/Fail	Comments
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Protective Earth Resistance		Ω		Limit 0.2 Ω
5	Earth Leakage		—	—	Limit NC:300μA SFC:1000μA
	Normal condition(NC)		μA		
	Single Fault condition(SFC)		μA		
6*	Patient Leakage Current		—	—	Limit NC:10μA, SFC: 50μA
	Normal condition(NC)		μA		
	Single Fault condition(SFC)		μA		
7*	Mains on Applied Part Leakage				Limit 50μA
8*	Patient Auxiliary Current		—	—	Limit NC:10μA, SFC: 50μA
	Normal condition(NC)				
	Single Fault condition(SFC)				
9	Functional test (parameters tested):				

Note: The test items marked "*" are needed only for incoming inspections and after repairs or modifications that may have affected lead leakage [NFPA 99 (2005)8.5.2.1.3].

Deficiency / Note:

Name: _____ Date / Signature: _____

ELECTRICAL SAFETY INSPECTION FORM

International version

Overall assessment:

☐ Scheduled inspection — Test item: 1, 2, 3, 9

☐ Unopened repair type — Test item: 1, 2, 3, 9

☐ Opened repair type, not modify the power part including transformer or patient circuit board — Test item: 1, 2, 3, 4, 5, 9

☐ Opened repair type, modify the power part including transformer or patient circuit board — Test item: 1, 2, 3, 4, 5, 6, 7, 8, 9

Location			Technician	
Equipment			Control Number	
Manufacturer	Model		SN	
Measurement equipment /SN			Date of Calibration	
INSPECTION AND TESTING			Pass/Fail	Comments
1	Power Cord Plug			
2	Device Enclosure and Accessories			
3	Device Labeling			
4	Protective Earth Resistance	Ω		Limit 0.2 Ω
5	EARTH Leakage	—	—	Limit NC:500μA SFC:1000μA
	Normal condition(NC)	μA		
	Single Fault condition(SFC)	μA		
6*	Patient Leakage Current	—	—	Limit CF AP NC:10μA, SFC: 50μA BF AP NC:100μA,SFC: 500μA
	Normal condition(NC)	μA		
	Single Fault condition(SFC)	μA		
7*	Mains on Applied Part Leakage			Limit CF AP: 50μA BF AP: 5000μA
8*	Patient Auxiliary Current	—	—	Limit CF AP NC:10μA,SFC: 50μA BF AP NC:100μA,SFC: 500μA
	Normal condition(NC)			
	Single Fault condition(SFC)			
9	Functional test (parameters tested):			

Note: The test items marked "*" are needed only for incoming inspections and after repairs or modifications that may have affected lead leakage [NFPA 99 (2005)8.5.2.1.3].

Deficiency / Note:

Name: _____ Date / Signature: _____